UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AT&T SERVICES INC., T-MOBILE USA, INC., CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, ERICSSON INC., AND NOKIA OF AMERICA CORPORATION,
Petitioners

v.

ASUS TECHNOLOGY LICENSING INC. AND CELERITY IP, LLC
Patent Owner.

Patent No. 10,148,402

IPR Case No.: IPR2024-01121

PETITION FOR *INTER PARTES* REVIEW OF CLAIMS 1–4, 12–15 OF U.S. PATENT 10,148,402 UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.100 ET SEQ.

DECLARATION OF CRAIG BISHOP

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I. INTRODUCTION

I, Craig Bishop, declare the following:

1. I have been retained as an independent expert witness on behalf of AT&T Services Inc., T-Mobile USA, Inc., Cellco Partnership d/b/a Verizon Wireless, Ericsson Inc., and Nokia of America Corporation ("Petitioners"), related to the *Inter Partes* Review ("IPR") of U.S. Patent No. 10,148,402 ("the '402 patent").

2. I am being compensated for my work in this matter at my normal consulting hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this investigation. My compensation is not contingent on the results of my study, the substance of my opinions, or the outcome of this matter.

3. I have no financial interest in the '402 patent and have had no contact with the named inventors of said patent. Neither have I reviewed the '402 patent in detail, nor do I have any personal interest in the outcome of this IPR.

4. In forming the opinions expressed in this declaration, I have considered the reference materials cited herein and my own academic background and professional experiences as outlined below.

5. Whilst I have attempted to organize the information presented in this declaration into helpful sections and/or divisions, my opinions are supported by the

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information in the declaration in its entirety.

II. QUALIFICATIONS

6. My complete qualifications and professional experience are described in my *curriculum vitae*, a copy of which is attached as **Appendix 1**. The following is a summary of my relevant qualifications and professional experience.

7. I earned my Bachelor of Electronic Engineering degree with Honors from Polytechnic of Central London in 1989. In 2005, I earned my MSC in Computer Science with Distinction from the University of Kent.

8. After graduating with my first degree, I worked as an operations engineer at the British Broadcasting Corporation (BBC) for 4 years, then as a civil servant at the UK Radiocommunications Agency until 1996, during which time I became involved in telecommunications standardization in the European Telecommunication Standards Institute ("ETSI"), working in particular in Technical Committee Radio Equipment and Systems (TC RES2) concerned with the standardization of Private Mobile Radio (PMR). From 1994 through 1996, I acted as Rapporteur for voice and data related PMR standards ETS 300 113, ETS 300 219 and ETS 300 390. I participated as the only TC RES2 delegate on behalf of the UK Radiocommunications Agency, generating proposals in support of UK administration and business requirements, downloading and reviewing other meeting input documents, and proposing changes as necessary to ensure input

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documents and the resulting specifications were in line with said requirements.

9. In 1996, I joined Samsung Electronic Research Institute as a Senior Standards Engineer where I worked for 16 years, eventually becoming Director of Standards and Industry Affairs in 2011. My work at Samsung mainly focused on the standardization of Global System for Mobile Communications (GSM)/ General Packet Radio Service (GPRS), Universal Mobile Telecommunications System (UMTS), the IP Multimedia subsystem (IMS), and Long-Term Evolution (LTE)/ Evolved Packet System (EPS) systems. Initially, I participated in ETSI Special Mobile Group (SMG) committees SMG1, SMG2, SMG4, SMG5, and SMG9, and relevant UMTS related sub-committees working on the air interface radio access network protocols, service, and terminal aspects of UMTS and GSM/GPRS until 1999. In particular, I was a participant in the ETSI SMG2 meetings leading up to selection of Wideband Code Division Multiple Access (WCDMA) as the radio access technology for the Frequency Division Duplex (FDD) mode of UMTS.

10. Beginning in 1998, I worked as a Principal Standards Engineer on the 3rd Generation Partnership Project (3GPP) on UMTS. I have been involved with 3GPP since its inception. I attended the inaugural 3GPP Technical Specification Group (TSG) meetings held in December 1998, and I began attending Working Group (WG) meetings in 1999. Specifically, I was a regular participant in Radio Access Network (RAN) WG1, Services & System Aspects (SA) WG1, Terminals

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(T) WG2, but I also attended TSG RAN and T plenary meetings and sometimes other Working Groups and covering similar technical aspects as in my previous work in ETSI. As an example, RAN WG1 was, and is, a Working Group responsible for the specification of the physical layer of the radio Interfaces for UE including physical layer procedures. As part of this work, I would prepare meeting contributions in support of Samsung's research and development activities. Also, by way of preparation for each meeting, I would download all contributions and review those of interest to Samsung, and where necessary, prepare additional input to the meeting based on said review.

11. Beginning in 2000, I acted as project manager and then as system engineering manager at Samsung, providing technical requirements for the team working on Samsung's UMTS modem development. This involved scrutiny of ongoing standardization work, particularly in RAN WG1, RAN WG2, and TSG Core Network (CN) WG1, from which I would download, and assess the impact of, contributions on Samsung's development projects, ensuring that Samsung's development team was kept informed about the latest developments as layers 2 and 3 of the UMTS standard were stabilized.

12. During this period, in addition to authoring and presenting technical contributions for the 3GPP standard, and producing technical requirements for the radio modem, I acted as Rapporteur for 3GPP Technical Reports covering User

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Equipment ("UE") capability requirements (3GPP TR 21.904) from 1999–2000, and the Evolution of the 3GPP System (3GPP TR 21.902) in 2003 (the first Study Item to consider the 3GPP system beyond UMTS towards LTE/EPS).

13. In 2005, I became Head of Advanced Technologies, Standards and Regulation (ATSR) at Samsung. In addition to my managerial duties which included responsibility for standards, research, and regulatory engineers including three standards engineers who were regularly attending 3GPP RAN WG2 and Core Network and Terminals (CT) WG1 Working Groups, I personally continued to work on 3GPP standardization issues. From 2005 until 2008, I regularly attended and participated in SA WG2 meetings, mainly focusing on IP Multimedia Subsystem (IMS) including voice over IMS but also looking at wider Evolved Packet System (EPS) related issues. From 2008 until 2011, I regularly attended and participated in SA WG1 meetings. I also attended SA plenary meetings from 2008 until I left Samsung in 2013. As well as generating contributions in support of Samsung's research and development as preparation for each meeting, I would download and review documents from other 3GPP members, identifying those of interest to Samsung and, where necessary, preparing additional contributions on behalf of Samsung. The work required a sound working knowledge of the broader 3GPP system to ensure effective management of the ATSR team, effective participation in meeting discussions, expert assessment of third-party standards contributions, and

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provision of implementation guidance to Samsung developers.

14. From 2005 until I stopped attending SA WG1 meetings in 2011, I authored and presented over 100 contributions to SA WG2 and SA WG1 meetings at 3GPP and appeared as an author/co-author on 18 patent applications related to User Equipment operation in the IMS and the 3GPP Core Network.

15. In 2011, I became Director of Standards and Industry Affairs at Samsung, and in November of that year I was elected to the Board of ETSI on which I served for a term of 3 years until November 2014. In this position I gained further perspective on the organisation, management, and activities of ETSI and its Technical Committees and Partnership Projects including 3GPP.

16. Since leaving Samsung in January 2013, I have formed my own consulting company which is a member of ETSI, and as part of various projects undertaken, I have continued to regularly access the ETSI and 3GPP document servers, and to keep abreast of ETSI and 3GPP document handling and publication practices.

17. Through my extensive work in ETSI and on 3GPP standardization issues over the years, I have become very familiar with ETSI and 3GPP practices for when and how the technical standards (including revisions thereto) and other standards-related contributions are made publicly available, including in the 1999-2012 timeframe when I was attending or monitoring various 3GPP Working Groups

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including RAN WG1 and RAN WG2, and since 2013 in support of my work as a independent standardisation consultant.

18. For purposes of my analysis in this declaration, I have been informed that a person of ordinary skill in the art ("POSITA") in the field of the '402 patent at the time of the alleged invention of the '402 patent would have had a B.S. in Electrical Engineering or a related field with at least three years of experience designing, developing, and/or testing telecommunication systems. A POSITA would also have familiarity with the wireless standards and well-known protocols for accessing wireless networks. This definition is approximate, and more education may substitute for industry experience or vice versa.

III. PUBLIC AVAILABILITY OF 3GPP STANDARDS PROPOSALS AND OTHER DOCUMENTS

19. Based on my years of experience working in various capacities in 3GPP and on 3GPP standards issues, I am familiar with the regular business practices of the 3rd Generation Partnership Project (3GPP) relating to technical documents including specifications, draft standards and proposals, and standards-related technical contributions, as well as the business practices through which 3GPP makes these documents public.

A. Prominence and Purpose of 3GPP

20. 3GPP was inaugurated in December 1998 to produce Technical

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Specifications and Technical Reports for the Universal Mobile Telecommunications System (UMTS), a 3G Mobile System based on evolved GSM core networks and a new radio access network known as UTRA (UMTS Terrestrial Radio Access). **Appendix 2** at 2, 3 ("[3GPP] Partnership Project Description"); **Appendix 3** at 1; **Appendix 4** at 5. At that time, various standards organisations agreed to cooperate to produce a "complete set of globally applicable Technical Specifications" that would then be transposed into standards by the relevant standardization bodies (also known as Organizational Partners). **Appendix 2** at 3, 5 ("[3GPP] Partnership Project Description"). 3GPP "attracted a very strong commitment from organisations and companies around the world, reflecting the truly global nature of the project". **Appendix 4** at 7.

21. 3GPP is a global initiative partnership made up of Organizational Partners, Market Representation Partners, and Individual Members. **Appendix 5** at 8, 9; **Appendix 2** at 10. Today, 3GPP unites seven telecommunications standard development organisations ("Organizational Partners") from around the world: the Association of Radio Industries and Businesses (ARIB) and the Telecommunication Technology Committee (TTC) from Japan, the China Communications Standards Association (CCSA) from China, the Telecommunications Standards Development Society, India (TSDSI) from India, the Telecommunications Technology Association (TTA) from Korea, the European Telecommunications Standards

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Institute (ETSI), and the Alliance for Telecommunications Industry Solutions (ATIS) from the United States. These Organizational Partners are regional standards organisations that have the authority to define, publish, and set standards for their respective regions. **Appendix 2** at 12. 3GPP also includes "Market Representation Partners" that represent various industry perspectives and offer market advice. **Appendix 5** at 9 (3GPP Working Procedures, "Market Representation Partnership"); **Appendix 2** at 14; **Appendix 4** at 5. Additionally, 3GPP includes individual member companies ("Individual Members") that participate in 3GPP through their membership in a 3GPP Organizational Partner. **Appendix 5** at 9 (3GPP Working Procedures, "Individual Membership"); **Appendix 6** at 5 (textbook including a chart showing 3GPP structure at the time of publication); **Appendix 8** at 9, 10. As an example of how prominent 3GPP was and remains in the industry, there were 471 participating Individual Members in 2016. **Appendix 7** at 7 (3GPP Project Coordination Group document showing 3GPP membership numbers to 2016). There were 781 individual members as of February 2024. **Appendix 9**.

22. As noted in paragraph 20, a primary goal of 3GPP is to provide an environment to produce technical specifications and technical reports that define and standardize technologies covering cellular telecommunications networks, including User Equipment or Mobile Device (UE) technologies, Radio Access Network (RAN) technologies, Core Network (CN) technologies, and service and system

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capabilities such as work on codecs, security and quality of service. The specifications also provide hooks for interworking with non-3GPP networks including but not limited to Wi-Fi networks.

23. Given the prominence of 3GPP in the wireless communication industry, beginning in 1999 and continuing through today, interested POSITAs were tracking the developments of the latest 3GPP specifications and reports to ensure timely development of products and services by their companies that were consistent with the standards being developed. In other words, it is my opinion that a POSITA would have to be familiar with 3GPP and with the specification-related documents produced as part of the 3GPP process in order to properly perform his or her job. Without access to and knowledge of the 3GPP documentation, including for example the substantive contents of 3GPP technical specifications, an engineer could not develop products that were interoperable with the worldwide 3G, 4G, and 5G standards. Because 3GPP documents were an important aspect of a POSITA's professional experience, textbooks and articles about cellular communications commonly directed readers to the 3GPP website for information regarding standards development. **Appendix 4** at 9 (directing readers to the 3GPP website at the conclusion of the chapter on the success of 3GPP in the standards development process). As a POSITA myself, I would regularly visit the 3GPP website for the latest developments mobile communications standards setting and refer colleagues

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involved in the development of such devices to the 3GPP website as a valuable reference.

24. My personal experience at Samsung confirms 3GPP's prominence in the wireless industry. For example, engineers and managers at Samsung who were responsible for implementing 3GPP compliant modem software (and who were not attending 3GPP meetings or involved with development of the 3GPP standard in any direct way) would often enquire as to which version of a given 3GPP specification they should be developing. Further, between 2000 and 2004, part of my role at Samsung involved advising software engineers implementing the 3GPP standard on the correct interpretation of the specifications and ensuring that they were made aware of any changes and proposals made during the 3GPP standards development process that would impact their work. I also for a time maintained an internal company database that tracked 3GPP approved changes, to help the software engineers at Samsung implementing the 3GPP standard more readily stay informed as to changes that would impact their work. The database also included links to relevant 3GPP documents so that engineers could access the documents directly. In short, the technical output of 3GPP was, and continues to be, well known at 3GPP member companies, even for engineers who were not directly involved with designing the 3GPP system or contributing to the 3GPP standard process.

B. 3GPP's Policy of Making Documents Public

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25. 3GPP's policy was to make 3GPP documents available to the public, including to interested POSITAs. The free availability of 3GPP documents to any interested member of the public was widely recognized in the industry. As an example of the prominence of 3GPP and its place in the wireless standards industry, I note that textbooks directed readers to the 3GPP website for information about relevant standards. For example, **Appendix 6** at 6, 9 ("The latest specifications can be obtained from 3GPP [9]", "[9] http//:www.3GPP.org"); **Appendix 8** at 10 ("3GPP TSs and TRs are publicly available at the 3GPP web site at either of the following URIs: http://www.3gpp.org/specs/specs.htm http://www.3gpp.org/ftp/Specs/archive/"). Because the purpose of 3GPP is worldwide adoption of a common standard, no restrictions on distribution or discussion have ever been placed on 3GPP documents. **Appendix 10** at 9 ("No password is needed to access any information on the 3GPP Web site, all information is openly published").

C. 3GPP Structure and Standards Development Process

26. Within 3GPP, responsibility for producing specifications was delegated to the Technical Specification Groups (TSGs). **Appendix 5** at 13 (3GPP Working Procedures, "TSG tasks"). At its inception, 3GPP was divided into four Technical Specification Groups (TSGs), each covering a particular category of technology. **Appendix 2** at 31 (3GPP Partnership Project Description); **Appendix 6** at 5, 6

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(textbook listing four TSGs and noting the subsequent addition of a fifth TSG); **Appendix 4** at 6, 11, 12. Each TSG is further divided into a number of Working Groups (WGs). **Appendix 8** at 8, 9; **Appendix 4** at 6; see also **Appendix 5** at 13 (3GPP Working Procedures). Two of the TSGs from 1999 are still in existence in 2024: TSG Radio Access Networks (RAN) and TSG Service & Systems Aspects (SA). The activities of two other TSGs, TSG Core Networks (CN) and TSG Terminals (T), were amalgamated under Core Network and Terminals (CT) following the closure of TSG T in 2005, with responsibility for terminal test specifications being moved to a RAN working group (RAN WG5). The fifth TSG, GSM EDGE Radio Access Networks (GERAN), was responsible for evolution of the GSM radio technology from 2000 until that TSG closed in 2016 and its work was transferred to a RAN working group (RAN WG6) which was itself closed in July 2020.

27. The TSGs held quarterly plenary meetings where members' contributions, draft specifications/reports, and other documents that had been agreed upon by the Working Groups were presented for discussion and approval. **Appendix 5** at 23 (3GPP Working Procedures, "Deliverable types," stating that Technical Specifications and Technical Reports are "drawn up by the TSGs" and are approved by TSGs); **Appendix 8** at 9 ("3GPP Deliverables"). Once a Technical Specification was or Change Requests creating a new version of a Technical Specification were,

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formally approved by TSG plenary, the latest version of said Technical Specification would be created by the Mobile Competence Centre (MCC) and uploaded to the file server. **Appendix 10** at 6; **Appendix 11** at 1. In that way, the conclusion of 3GPP TSG plenary meetings serves as notice that new versions of specifications incorporating Change Requests approved by the TSG meeting will shortly be made available on the public 3GPP server.

28. As part of the standards development process, delegates could submit contributions on behalf of the Individual Members. Members had an incentive to stay updated on 3GPP developments because those members usually wanted to contribute to the standard and make suggestions as to what technology and/or features should (or should not) be included. Delegates also attended 3GPP meetings to keep their employers abreast of developments related to the standards that would ultimately apply to those members and the products those members (*e.g.*, companies) produced. 3GPP members around the world and the interested POSITAs employed by them would have been motivated to stay up to date regarding 3GPP technology evolution to ensure their research and development programmes remained relevant to the systems being specified and that their products were compliant with the published 3GPP specifications. In light of this need to follow the standards development process, delegates often distributed 3GPP-related documents far beyond the attendees at 3GPP meetings. This was certainly my experience at

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Samsung.

D. 3GPP Documents

1. Technical Specifications and Reports

29. The technical specifications and reports developed by 3GPP were, and still are, driven by the technical contributions of 3GPP members. As part of that development process, various types of documents were produced. The 3GPP process involved the consideration of temporary documents ("TDocs," also referred to as "contributions,"), many of which constituted technical proposals for how the system should be implemented and were adopted as the basis for parts of the technical specifications.

30. As I noted in paragraphs 20 and 22, a primary purpose of 3GPP is to prepare, approve, and maintain globally applicable Technical Specifications and Technical Reports. **Appendix 5** at 7 (3GPP Working Procedures, "Purpose"). A "Technical Specification," as defined by 3GPP, is "[a] 3GPP output document containing normative provisions approved by a Technical Specification Group". **Appendix 5** at 28. 3GPP would (and still does) periodically freeze a complete set of standards (referred to as a "Release"), and each set would include many new specifications. **Appendix 10** at 6. 3GPP would also make publicly available draft specifications that would usually be included as part of the next Release once approved.

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31. It was widely known that Technical Specifications (and Technical Reports) were publicly available on 3GPP's website. It was also well known that the latest version of a given specification that was under change control would be made available following each TSG Plenary meeting responsible for that specification, and that TSG Plenary meetings usually occur four times per year. **Appendix 10** at 7; **Appendix 11** at 1.

32. Latest and previous versions of technical specifications could be easily accessed from the 3GPP website. The specifications page provided direct links to the specifications area in the 3GPP website's file repository. **Appendix 11** at 1. In the 2016 timeframe, the specifications page listed the specifications by the date of the approval of the latest versions reflecting the TSG plenary meeting date. *E.g.*, **Appendix 11** at 1.

33. Additionally, the 3GPP specifications followed a clear numbering scheme to help the public, including interested POSITAs, identify the subject matter of each specification. **Appendix 12** at 1. As described on the 3GPP Numbering Scheme webpage, all 3G and GSM specifications had a specification number of 4 or 5 digits, where the first two digits defined the series. **Appendix 12** at 1. The Numbering Scheme webpage included a table showing the subject matter corresponding to each series. **Appendix 12** at 1. For example, the "36 series" focused on Evolved UTRA (LTE) aspects. **Appendix 12** at 1. An interested POSITA

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could narrow down the relevant specifications based on whether the specification applied to only 5G NR, evolved UTRA (aka 4G or LTE), to 3G, to GSM, or to GSM, 3G and evolved UTRA (GSM only specifications were transferred from ETSI to 3GPP in July 2000). For a specification in the 21–35 series, this could be determined based on the third digit of the specification number, where a "0" would indicate that the specification applied to both systems. **Appendix 12** at 1. Specifications outside the 21–38 series in 2016 applied only to GSM systems. **Appendix 12** at 1.

34. The specifications were stored on the 3GPP website's file repository as zipped files, where the filenames followed the structure: SM[-P[-Q]]-V.zip. This format corresponded to the numbering scheme discussed in paragraph 33. "S" represented the series number; "M" represented the mantissa (the part after the series number); "P" represented an optional part number; "Q" represented an optional sub-part number; and "V" represented the version number (without the separating dots). **Appendix 12** at 2.

35. The Working Groups would create incremental versions of the draft specifications (*e.g.*, V0.2.1, V1.0.0, V1.1.0, etc.). These versions were made available on the 3GPP website's file repository which is accessible from the 3GPP specifications page. The version numbering scheme for Technical Specifications and Technical Reports was standardized by 3GPP. The version number included three fields: the major version field, the technical version field, and the editorial version

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field. **Appendix 13** at 3. The major version field reflects the stage of the specification, with "0" representing an immature draft and a value of "3" or greater representing a specification that has been approved by the relevant TSG and thus had been moved to change control. **Appendix 13** at 3. The technical version field begins at zero and is incremented every time a technical change is made to the specification (either as part of the drafting process or as part of an approved change request). **Appendix 13** at 3. The editorial version field begins at zero and is incremented each time a non-technical change is made to the specification (*e.g.*, to fix a typo or formatting issue). **Appendix 13** at 3.

36. I understand that the alleged invention in the '402 patent relates to cellular telecommunications networks, and more particularly to methods, systems, and computer program products for handling, or assisting in handling, control signalling for beam management. Any POSITA interested in methods, systems, and computer program products for handling, or assisting in handling, control signalling for beam management would have been monitoring 3GPP's activities in this area and would probably have been already participating as a full or associate member or observer in the standard development process or would have at least known that information regarding the proposed revisions to the technical specifications under discussion were available through 3GPP.

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2. 3GPP TDocs

37. As mentioned in paragraph 29, the technical specifications and reports developed by 3GPP were and are driven by the technical contributions of 3GPP member companies. As part of that development process, various types of documents were produced and submitted. As relevant to this case, the 3GPP process involved the consideration of temporary documents or "TDocs," which are also referred to as proposals, contributions, or change requests. The agreement of proposals submitted as TDocs results in the production of technical specifications.

38. Prior to each Working Group meeting, members of the Working Group would prepare TDocs to identify, discuss, and/or propose a new feature or change(s) to an existing feature or to identify a technical issue for discussion. Interested POSITAs would have known that TDocs could be a helpful source of technical information regarding the 3GPP specifications.

39. Each TDoc was assigned a TDoc number, according to a standard format set by 3GPP.[1] As described in the 3GPP Working Procedures, the numbering system followed the format xminnzzzz. **Appendix 5** at 20. This general naming convention has been in use since at least 1999 with only minor variations. Within that format, "x" referred to the relevant TSG. For example, "R" was used for TSG

[1] Documents other than technical contributions (such as meeting reports) were also assigned TDoc numbers for ease of reference.

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RAN. Likewise, "m" referred to the relevant Working Group. **Appendix 5** at 20. A document for RAN WG1 would therefore begin with "R1". The two digits "nn" represented the year (*e.g.*, 16), and the digits "zzzz" represented the unique document number. This document number was used as the TDoc's filename.

40. Each TDoc would include in its header the meeting at which the contributor intended the TDoc to be discussed. Most TDocs were uploaded to the 3GPP website for public viewing prior to the relevant Working Group meeting listed on the TDoc, although some TDocs including those created at meetings, were uploaded during or after the meeting. **Appendix 10** at 8. The documents were uploaded to the public file repository in an area allocated to the particular Working Group. **Appendix 14** at 2 (RAN WG1 homepage with link to WG1's "Documents area"). Immediately upon upload, any member of the public could download and access the TDocs and other documents offered for discussion. This process has been in place since I began attending Working Group meetings in 1999.

E. The 3GPP Website's Public File Repository

41. All TDocs, technical reports, and technical specifications were also freely available to interested member of the public through the public file repository accessible via the 3GPP website. Interested members of the public would have been well aware of 3GPP and of the 3GPP website. 3GPP documents were accessible to any member of the public through the 3GPP website without providing any login

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credentials or other exclusive access criteria.

42. It is my recollection that, during the 2016 timeframe, any interested member of the public could locate relevant documents of interest on the 3GPP website using reasonable diligence based on the website's indexing scheme or the TDoc's naming convention. The documents on the 3GPP website were (and remain) organized according to the relevant Working Groups within 3GPP (each of which focused on particular subject matter) and then further organized based on the meetings of those groups. POSITAs would have known which Working Groups focused on particular subject matter.

43. An interested member of the public could locate documents of interest by first navigating a web browser to the 3GPP website (www.3gpp.org). In the 2016 timeframe, to locate documents from the 3GPP home page, a user could have clicked "Specification Groups" **Appendix 15**. The corresponding webpages contained links to the 3GPP's public file repository (*e.g.*, through the "Documents area" of a Working Group page). **Appendix 14**. Instead of accessing the 3GPP file repository from the 3GPP website home page, a user could have also accessed the file repository through the web address www.3gpp.org/ftp or directly using ftp client software connected to ftp.3gpp.org. A POSITA was also able to search for relevant documents using keywords on the search facility on the 3GPP website from at least 2000, and from 2015 using the 3GPP search portal (https://portal.3gpp.org/#/),

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where an interested person could search for documents by title and source, among other things.

44. The top two levels of indexing within the file repository were based wholly on subject matter, as reflected by the division of subject matter among the various TSGs and Working Groups. Specifically, an individual would select the relevant TSG covering the subject matter of interest. **Appendix 16**.

45. If the individual were interested in the radio access aspects of 3GPP, they would click "tsg_ran". From there, the individual would click on the particular RAN Working Group covering the subject matter of interest. **Appendix 17**.

46. For example, if the individual were interested in the Radio Interface physical layer, the individual would know to choose the folder for WG1. Once a user is in the relevant Working Group folder (RAN WG1 in this example), an individual would see a list of all meetings held by RAN WG1. **Appendix 18**.

47. As shown, a folder existed for each meeting. For example, "TSGR1_86b" corresponded to TSG RAN WG1 Meeting #86bis, and the timestamp associated with the meeting #86b directory indicates that, as of July 2016, the TSGR1_86b directory had most recently been updated on 5 January, 2016. **Appendix 18** at 3.

48. A POSITA would know which meeting(s) would have covered particular subject matter based on the working groups area of responsibility (*e.g.* for

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RAN WG1 - **Appendix 14)**, and from publicly available meeting agendas. *E.g.*, **Appendix 19** (see link to agenda for RAN WG1 Meeting #86b). Many POSITAs received a link to the meeting agenda directly via the 3GPP Working Group email reflector lists. **Appendix 20**. Further, an individual could ascertain what subject matter was addressed at each meeting by reviewing the report issued after each meeting, stored in the Report directory and also linked in, or attached to, an email sent via the group's email reflector. **Appendix 19**; **Appendix 21**.

49. In my experience, whilst the servers used for 3GPP file repository and many of its directories have been updated since 1999, and directories may as a result have later dates associated with them (*e.g.*, reflecting the last time they were modified in some way or their contents were updated), the original upload date for files including specifications has always been preserved, providing a true and accurate indication of their earliest availability for download.

50. Once an individual navigated to the desired meeting folder, for example "TSGR1_86b" the individual could then select the "Docs" folder to view the documents associated with that meeting. The documents within this folder were listed by TDoc number, and interested members of the public would have known to review the meeting report for each meeting to confirm which topics were discussed at that meeting. *E.g.*, **Appendix 22**.

51. Many TDocs were uploaded to the public file server for public viewing

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prior to the relevant meeting (although some TDocs, particularly those created during meetings, were submitted during or soon after the meetings). Throughout and since my participation in 3GPP, it was always recommended that delegates attending a meeting download the relevant set of documents from the 3GPP file repository onto their personal computers prior to each meeting. Given that any interested member of the public could and was likely to subscribe to the Working Group listserv, it would have been simple to locate the location of relevant TDocs on the 3GPP server based on the information sent out over the listserv.

52. 3GPP's public file repository provides a reliable mechanism for identifying the date and time a document was uploaded to the website and then available to download for public viewing. When a document is uploaded, the file server automatically assigns the document a time stamp—*i.e.*, an accurate and automatically computer-generated electronic record of when the document was uploaded—as part of the regular business practices of 3GPP. **Appendix 10** at 8 (3GPP FAQs). This has always been the practice regarding uploading documents to the 3GPP file repository, and my personal experience confirms that the time stamps have always been a reliable way to determine when a file was uploaded to the 3GPP website and immediately available for public download.

53. Following each 3GPP meeting, the secretary would usually distribute the meeting minutes via the corresponding email list with a request for comments.

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E.g., **Appendix 21**. Said email would effectively therefore inform subscribers that the meeting had taken place, would inform subscribers of the documents that had been treated (or not), and in the event that the meeting was a TSG plenary meeting, serve as notice that new versions of specifications incorporating Change Requests approved by the TSG meeting, would shortly be made available on the 3GPP public server. Further, an interested member of the public following a certain topic would have known to check said report for related contributions as the reports always included a list of all TDocs submitted, indexed by contribution title, TDoc number, source, and agenda item (*e.g.*, Annex B of the report of RAN1 #86b, **Appendix 22a**).

IV. 3GPP EXHIBITS

A. Ex-1006: R1-1609515, TSG-RAN Working Group 1 Meeting #86b; Agenda Item 8.1.4.1: "On network beam switching and refinement (BM P-2)"

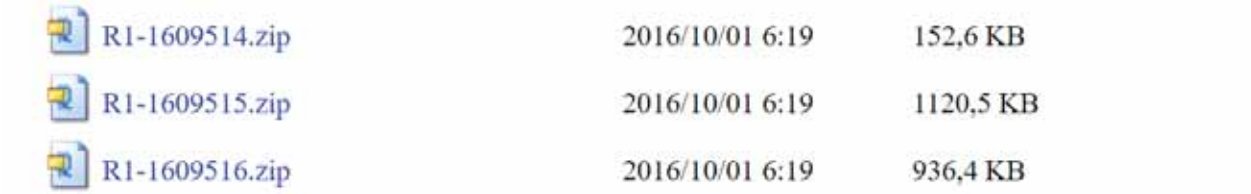
54. R1-1609515 is a technical contribution submitted to 3GPP TSG RAN WG1, meeting #86b, which was held between October 10 – 14, 2016. It follows the general naming format ("xminnzzzz") described in paragraph 39[2]. Accordingly, "R1" indicates that the contribution was submitted to RAN WG1, "16" indicates the year (2016) that this technical contribution was submitted, and "09515" is the unique

[2] Note that from RAN1 #86b in October 2016, RAN1 added another digit to the unique identifier "z" field to cater for the increasing number of Tdocs being submitted.

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number that was assigned to this contribution document. It is titled "On network beam switching and refinement (BM P-2)".

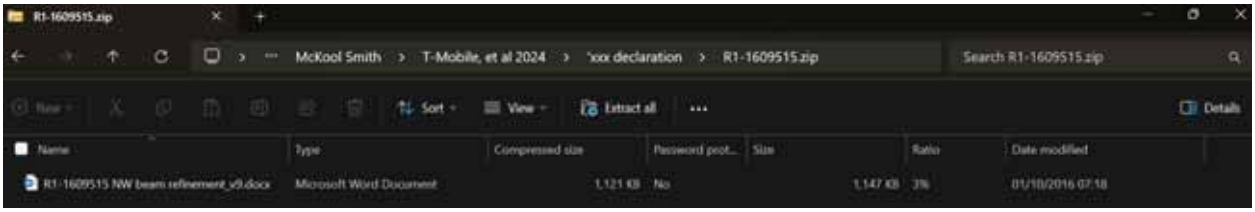
55. As I mention in paragraph 41 above, 3GPP meeting documents have always been, and were in the 2016 timeframe, made publicly available on the 3GPP public file server from where an interested member of the public exercising reasonable diligence could freely access them. To confirm the availability of R1-1609515 on the 3GPP document server in the 2016 timeframe, I navigated to the 3GPP website at http://www.3gpp.org, selected "3GPP Groups" from the drop down menu, and then selected the "RAN1 – Radio Layer 1 (Physical Layer)" from the 3GPP Groups page, and the "Documents area" link to access the public file server where documents for the TSG-RAN Working Group 1 are stored, and from where I navigated to the documents for RAN WG1 #86b. A true and correct copy of the relevant portion of the Documents directory listing produced by the file server website is provided below and in **Appendix 23** at 28.



56. The Docs directory index stated that R1-1609515 was uploaded on "2016/10/01". I selected the link for "R1-1609515.zip" and downloaded a zip file of

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the same name. The zip file contained a Microsoft Word document, "R1-1609515 NW beam refinement_v9.docx", with a date stamp of "01/10/2016" (European date format) the same date that the zip file was uploaded.



57. A true and correct copy of the document within the zip file (R1-1609515 NW beam refinement_v9.docx) is provided as Ex-1006. Based on my experience, I understand that these date stamps mean that R1-1609515.zip was uploaded to 3GPP's publicly available website on October 1, 2016, prior to the RAN WG1 #86b meeting, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of said document without restriction on October 1, 2016 and thereafter. The draft report from RAN WG1 #86b, first made available on October 20, 2016 (**Appendix 21**), confirms the availability of R1-1609515 at the meeting (**Appendix 22** at 78). I have no reason to believe that either the date stamp or the report from RAN WG1 #86b are inaccurate. I have therefore determined that R1-1609515 was publicly available on the file server no later than October 1, 2016.

58. Based on the information above, it is my opinion that R1-1609515 titled "On network beam switching and refinement (BM P-2)" and provided as Ex-1006

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was publicly available to download from the 3GPP file server no later than October 1, 2016 and could have been distributed thereafter without restriction. Further, it was publicly available at the 3GPP TSG RAN WG1 #86b meeting held October 10 – 14, 2016.

B. Ex-1012: R1-1613206, TSG-RAN Working Group 1 Meeting #87; Agenda Item 6.2.2.3: "WF on CDM Aggregation for 32 and 24 CSI-RS ports"

59. R1-1613206 is a technical contribution submitted to 3GPP TSG RAN WG1, meeting #87, which was held between November 14 – 18, 2016. It follows the general naming format ("xminnzzzz") described in paragraph 39[3]. Accordingly, "R1" indicates that the contribution was submitted to RAN WG1, "16" indicates the year (2016) that this technical contribution was submitted, and "13206" is the unique number that was assigned to this contribution document. It is titled "WF on CDM Aggregation for 32 and 24 CSI-RS ports".

60. As I mention in paragraph 41 above, 3GPP meeting documents have always been, and were in the 2016 timeframe, made publicly available on the 3GPP public file server from where an interested member of the public exercising reasonable diligence could freely access them. To confirm the availability of R1-

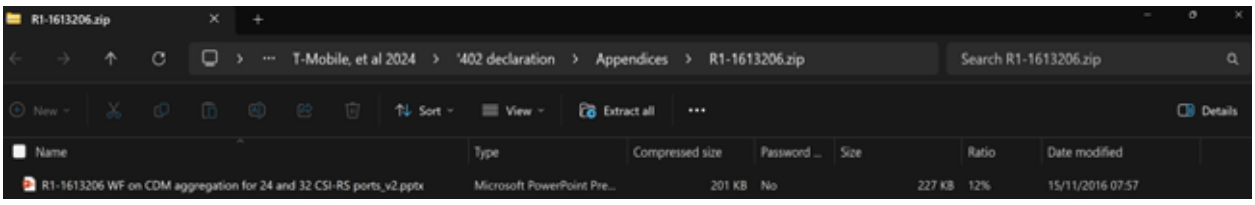
[3] Note that from RAN1 #86b in October 2016, RAN1 added another digit to the unique identifier "z" field to cater for the increasing number of Tdocs being submitted.

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1613206 on the 3GPP document server in the 2016 timeframe, I navigated to the 3GPP website at http://www.3gpp.org, selected "3GPP Groups" from the drop down menu, and then selected the "RAN1 – Radio Layer 1 (Physical Layer)" from the 3GPP Groups page, and the "Documents area" link to access the public file server where documents for the TSG-RAN Working Group 1 are stored, and from where I navigated to the documents for RAN WG1 #87. A true and correct copy of the relevant portion of the Documents directory listing produced by the file server website is provided below and in **Appendix 24** at 62.

R1-1613205.zip	2016/11/19 22:23	23,2 KB
R1-1613206.zip	2016/11/19 22:23	200,4 KB
R1-1613207.zip	2016/11/19 22:23	22 KB

61. The Docs directory index stated that R1-1613206 was uploaded on "2016/11/19". I selected the link for "R1-1613206.zip" and downloaded a zip file of the same name. The zip file contained a Microsoft Power Point document, "R1-1613206 WF on CDM Aggregation for 32 and 24 CSI-RS ports_v2.pptx", with a date stamp of "15/11/2016" (European date format) four days before the date that the zip file was uploaded.



62. A true and correct copy of the document within the zip file (R1-1613206 WF on CDM Aggregation for 32 and 24 CSI-RS ports_v2.pptx) is provided as Ex-1012. Based on my experience, I understand that these date stamps mean that R1-1613206.zip was uploaded to 3GPP's publicly available website on November 19, 2016, following the RAN WG1 #87 meeting, and that any member of the public could have downloaded the zip file, extracted the Power Point document enclosed, and viewed the contents of said document without restriction on November 19, 2016 and thereafter. The draft report from RAN WG1 #87, first made available on November 24, 2016 (**Appendix 25**), confirms the availability of R1-1613206 at the meeting (**Appendix 26** at 35). I have no reason to believe that either the date stamp or the report from RAN WG1 #87 are inaccurate. I have therefore determined that R1-1613206 was publicly available on the file server no later than November 19, 2016.

63. Based on the information above, it is my opinion that R1-1613206 titled "WF on CDM Aggregation for 32 and 24 CSI-RS ports" and provided as Ex-1012 was publicly available to download from the 3GPP file server no later than November 19, 2016 and could have been distributed thereafter without restriction. Further, it was publicly available at the 3GPP TSG RAN WG1 #87 meeting held November 14 -18, 2016.

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C. Ex-1013: R1-162686, TSG-RAN Working Group 1 Meeting #84bis; Agenda Item 7.3.3.1.2: "Specification impact of aperiodic CSI-RS"

64. R1-162686 is a technical contribution submitted to 3GPP TSG RAN WG1, meeting #84bis, which was held between April 11 - 15, 2016. It follows the general naming format ("xminnzzzz") described in paragraph 39. Accordingly, "R1" indicates that the contribution was submitted to RAN WG1, "16" indicates the year (2016) that this technical contribution was submitted, and "2686" is the unique number that was assigned to this contribution document. It is titled "Specification impact of aperiodic CSI-RS".

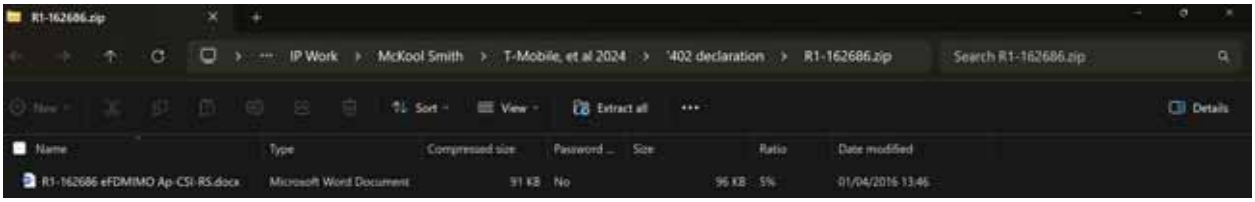
65. As I mention in paragraph 41 above, 3GPP meeting documents have always been, and were in the 2016 timeframe, made publicly available on the 3GPP public file server from where an interested member of the public exercising reasonable diligence could freely access them. To confirm the availability of R1-162686 on the 3GPP document server in the 2016 timeframe, I navigated to the 3GPP website at http://www.3gpp.org, selected "3GPP Groups" from the drop down menu, and then selected the "RAN1 – Radio Layer 1 (Physical Layer)" from the 3GPP Groups page, and the "Documents area" link to access the public file server where documents for the TSG-RAN Working Group 1 are stored, and from where I navigated to the documents for RAN WG1 #84bis. A true and correct copy of the relevant portion of the Documents directory listing produced by the file server

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website is provided below and in **Appendix 27** at 18.



66. The Docs directory index stated that R1-162686 was uploaded on "2016/04/01". I selected the link for "R1-162686.zip" and downloaded a zip file of the same name. The zip file contained a Microsoft Word document, "R1-162686 eFDMIMO Ap-CSI-RS.docx", with a date stamp of "01/04/2016" (European date format) the date that the zip file was uploaded.



67. A true and correct copy of the document within the zip file (R1-162686 eFDMIMO Ap-CSI-RS.docx) is provided as Ex-1013. Based on my experience, I understand that these date stamps mean that R1-162686.zip was uploaded to 3GPP's publicly available website on April 1, 2016, prior to the RAN WG1 #84bis meeting, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of said document without restriction on April 1, 2016 and thereafter. The draft report from RAN WG1 #84bis, first made available on April 21, 2016 (**Appendix 28**), confirms the availability of

R1-162686 at the meeting (**Appendix 29** at 55). I have no reason to believe that either the date stamp or the report from RAN WG1 #84bis are inaccurate. I have therefore determined that R1-162686 was publicly available on the file server no later than April 1, 2016.

68. Based on the information above, it is my opinion that R1-162686 titled "Specification impact of aperiodic CSI-RS" and provided as Ex-1013 was publicly available to download from the 3GPP file server no later than April 1, 2016 and could have been distributed thereafter without restriction. Further, it was publicly available at the 3GPP TSG RAN WG1 #84bis meeting held April 11 - 15, 2016.

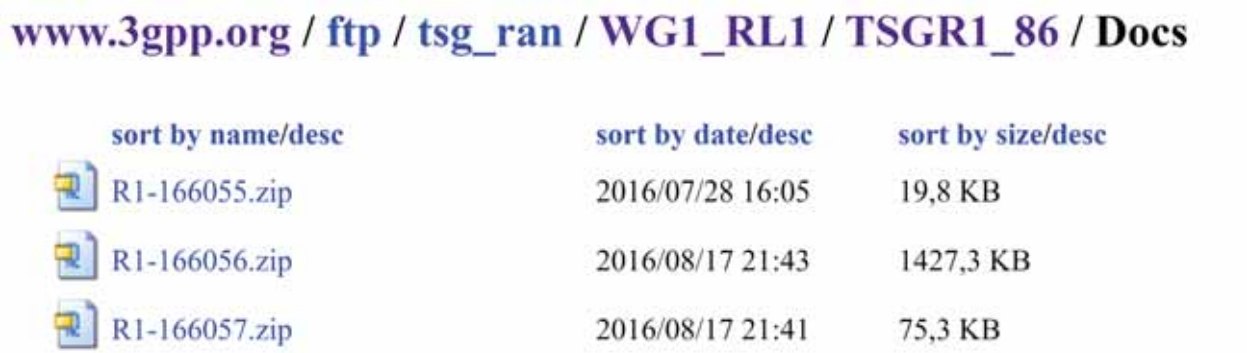
D. Ex-1014: R1-166056, TSG-RAN Working Group 1 Meeting #86; "Final Report of 3GPP TSG RAN WG1 #85 v1.0.0 (Nanjing, China, 23rd – 27th May 2016)"

69. R1-166056 is a meeting report submitted to 3GPP TSG RAN WG1, meeting #86, which was held between August 22 - 26, 2016. It follows the general naming format ("xminnzzzz") described in paragraph 39. Accordingly, "R1" indicates that the contribution was submitted to RAN WG1, "16" indicates the year (2016) that this technical contribution was submitted, and "6056" is the unique number that was assigned to this contribution document. It is titled "Final Report of 3GPP TSG RAN WG1 #85 v1.0.0 (Nanjing, China, 23rd – 27th May 2016)".

70. As I mention in paragraph 41 above, 3GPP meeting documents have always been, and were in the 2016 timeframe, made publicly available on the 3GPP

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public file server from where an interested member of the public exercising reasonable diligence could freely access them. To confirm the availability of R1-166056 on the 3GPP document server in the 2016 timeframe, I navigated to the 3GPP website at http://www.3gpp.org, selected "3GPP Groups" from the drop down menu, and then selected the "RAN1 – Radio Layer 1 (Physical Layer)" from the 3GPP Groups page, and the "Documents area" link to access the public file server where documents for the TSG-RAN Working Group 1 are stored, and from where I navigated to the documents for RAN WG1 #86. A true and correct copy of the relevant portion of the Documents directory listing produced by the file server website is provided below and in **Appendix 30** at 1.



www.3gpp.org / ftp / tsg_ran / WG1_RL1 / TSGR1_86 / Docs

sort by name/desc	sort by date/desc	sort by size/desc
R1-166055.zip	2016/07/28 16:05	19,8 KB
R1-166056.zip	2016/08/17 21:43	1427,3 KB
R1-166057.zip	2016/08/17 21:41	75,3 KB

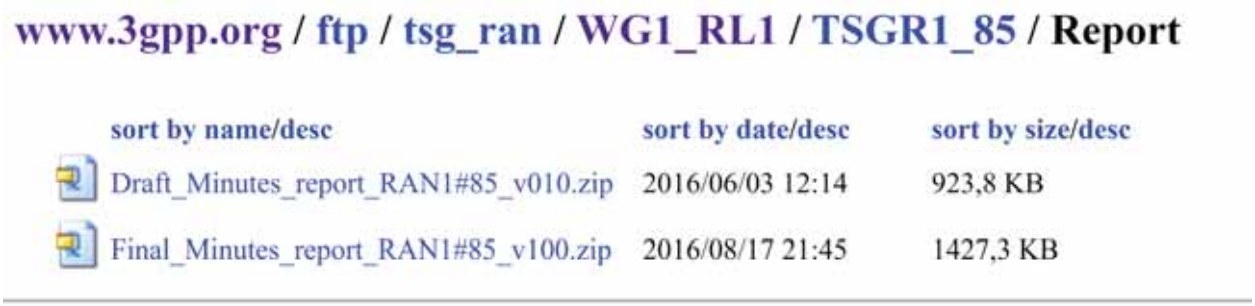
71. The Docs directory index stated that R1-166056 was uploaded on "2016/08/17". I selected the link for "R1-166056.zip" and downloaded a zip file of the same name. The zip file contained three files including a Microsoft Word document, "R1-166056 Final_Minutes_report_RAN1#85_v100.docx", with a date stamp of "17/08/2016" (European date format) the date that the zip file was

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uploaded.



72. A true and correct copy of the document within the zip file (R1-166056 Final_Minutes_report_RAN1#85_v100.docx) is provided as Ex-1014. Based on my experience, I understand that these date stamps mean that R1-166056.zip was uploaded to 3GPP's publicly available website on August 17, 2016, prior to the RAN WG1 #86 meeting, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of said document without restriction on August 17, 2016 and thereafter. Being a RAN1 meeting report, the file was also made publicly available in the RAN1 #85 meeting report directory on the same date.



73. The draft report from RAN WG1 #86, made available on September 3, 2016 (**Appendix 31**), confirms the availability of R1-166056 at the meeting

(**Appendix 32** at 8). I have no reason to believe that either the date stamps or the report from RAN WG1 #86 are inaccurate. I have therefore determined that R1-166056 was publicly available on the file server no later than August 17, 2016.

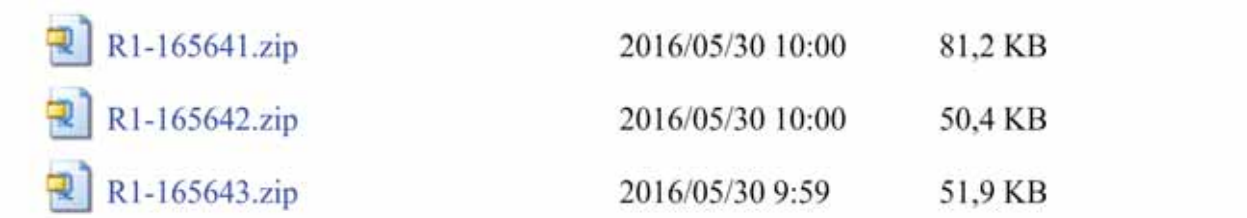
74. Based on the information above, it is my opinion that R1-166056 titled "Final Report of 3GPP TSG RAN WG1 #85 v1.0.0 (Nanjing, China, 23rd – 27th May 2016)" and provided as Ex-1014 was publicly available to download from the 3GPP file server no later than August 17, 2016 and could have been distributed thereafter without restriction. Further, it was publicly available at the 3GPP TSG RAN WG1 #86 meeting held August 22 - 26, 2016.

E. Ex-1015: R1-165642, TSG-RAN Working Group 1 Meeting #85; Agenda Item 7.1.6: "WF on Beamformed CSI-RS"

75. R1-165642 is a technical contribution submitted to 3GPP TSG RAN WG1, meeting #85, which was held between May 23 - 27, 2016. It follows the general naming format ("xminnzzzz") described in paragraph 39. Accordingly, "R1" indicates that the contribution was submitted to RAN WG1, "16" indicates the year (2016) that this technical contribution was submitted, and "5642" is the unique number that was assigned to this contribution document. It is titled "WF on Beamformed CSI-RS".

76. As I mention in paragraph 41 above, 3GPP meeting documents have always been, and were in the 2016 timeframe, made publicly available on the 3GPP

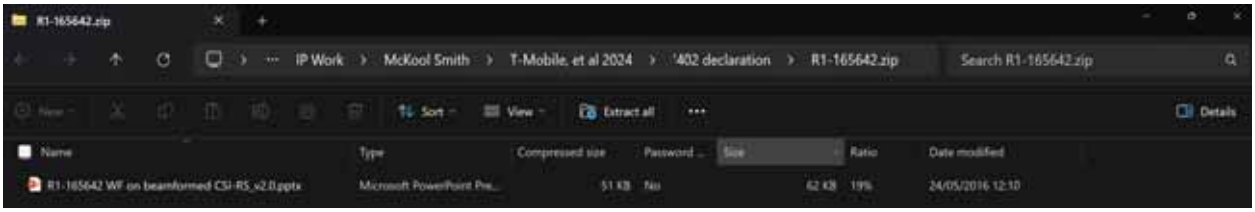
public file server from where an interested member of the public exercising reasonable diligence could freely access them. To confirm the availability of R1-165642 on the 3GPP document server in the 2016 timeframe, I navigated to the 3GPP website at http://www.3gpp.org, selected "3GPP Groups" from the drop down menu, and then selected the "RAN1 – Radio Layer 1 (Physical Layer)" from the 3GPP Groups page, and the "Documents area" link to access the public file server where documents for the TSG-RAN Working Group 1 are stored, and from where I navigated to the documents for RAN WG1 #85. A true and correct copy of the relevant portion of the Documents directory listing produced by the file server website is provided below and in **Appendix 33** at 49.



R1-165641.zip	2016/05/30 10:00	81,2 KB
R1-165642.zip	2016/05/30 10:00	50,4 KB
R1-165643.zip	2016/05/30 9:59	51,9 KB

77. The Docs directory index stated that R1-165642 was uploaded on "2016/05/30". I selected the link for "R1-165642.zip" and downloaded a zip file of the same name. The zip file contained a Microsoft Power Point document, "R1-165642 WF on beamformed CSI_RS_v2.0.pptx", with a date stamp of "24/05/2016" (European date format) six days before the date that the zip file was uploaded.

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78. A true and correct copy of the document within the zip file (R1-165642 WF on beamformed CSI_RS_v2.0.pptx) is provided as Ex-1015. Based on my experience, I understand that these date stamps mean that R1-165642.zip was uploaded to 3GPP's publicly available website on May 30, 2016, following the RAN WG1 #85 meeting, and that any member of the public could have downloaded the zip file, extracted the Word document enclosed, and viewed the contents of said document without restriction on May 30, 2016 and thereafter. The draft report from RAN WG1 #85, made available on April 21, 2016 (**Appendix 34**), confirms the availability of R1-165642 at the meeting (**Appendix 29** at 50). I have no reason to believe that either the date stamp or the report from RAN WG1 #85 are inaccurate. I have therefore determined that R1-165642 was publicly available on the file server no later than May 30, 2016.

79. Based on the information above, it is my opinion that R1-162686 titled "WF on Beamformed CSI-RS" and provided as Ex-1015 was publicly available to download from the 3GPP file server no later than May 30, 2016 and could have been distributed thereafter without restriction. Further, it was publicly available at the 3GPP TSG RAN WG1 #84bis meeting held May 23 - 27, 2016.

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V. CONCLUSION

80. Based on the information in section IV, A above, it is my option that Ex-1006, 3GPP R1-1609515 titled: "On network beam switching and refinement (BM P-2)" was publicly available to download from the 3GPP server without restriction on October 1, 2016.

81. Based on the information in section IV, B above, it is my option that Ex-1012, 3GPP R1-1613206 titled: "WF on CDM Aggregation for 32 and 24 CSI-RS ports" was publicly available to download from the 3GPP server without restriction on November 19, 2016.

82. Based on the information in section IV, C above, it is my option that Ex – 1013, 3GPP R1-162686 titled: "Specification impact of aperiodic CSI-RS" was publicly available to download from the 3GPP server without restriction on April 1, 2016.

83. Based on the information in section IV, D above, it is my option that Ex-1014, 3GPP R1-166056 titled: "Final Report of 3GPP TSG RAN WG1 #85 v1.0.0 (Nanjing, China, 23rd – 27th May 2016)" was publicly available to download from the 3GPP server without restriction on August 17, 2016.

84. Based on the information in section IV, E above, it is my option that Ex-1015, 3GPP R1-165642 titled: "WF on Beamformed CSI-RS" was publicly available to download from the 3GPP server without restriction on May 30, 2016.

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85. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

June 24, 2024



Printed Name: Craig Bishop

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APPENDIX 1

Curriculum Vitae

Name: Craig Bishop

Contact Tel No.: +44 (0)7984 564949 (mobile)

Email: craig@bishopcom.co.uk

Current job title: Independent Consulting Engineer, CEO

Address: 43 Ospringe Street, Faversham, Kent, ME13 8TW

Key Skills and Experience

- 35 years Telecoms, Radio and Broadcast experience
- 27 years experience of 2G/3G/4G telecoms standardisation
- Extensive knowledge of 3GPP and ETSI specifications and procedures including document handling and publication practices
- Sound understanding of 3GPP systems, including Radio Access Interfaces and Networks, Access Stratum protocols, Core Networks, Non-Access Stratum protocols, and IMS
- Experience of ETSI role from regulatory perspective (harmonised standards, mandates, spectrum, etc)
- Depositions, reports, and declarations as expert witness in cases on 3GPP technologies and on 3GPP & ETSI practices and procedures.
- Intellectual property analysis including prior art search and evaluation of patent essentiality
- Application of data analytics and machine learning techniques to standards and IP data
- Programming in Java, Python, C, Octave (Matlab)

Career History

Bishop Communications Ltd. 01/13 –

Independent Telecommuncations Standards and Intellectual Property Consultant

Company is a full ETSI member

Activities have included:

- Provision of expert support for IPR litigation from standards landscape analysis / background technical reports to expert testimony reports / declarations and depositions on matters including the public availability of 3GPP and ETSI prior art.
- Intellectual property analysis assessing strengths and weaknesses of patents and patent portfolios, conducting searches for prior art, evaluating patent essentiality, and acquring relevant documentation.
- Provision of expertise for EC funded ETSI Specialist Task Force (STF489) to produce implementation guidelines for Total Conversation for emergency services. Project delivered on time / budget and well received. Ouput published March 2016 as ETSI TR 103 201.
- Provision of expertise for ETSI Specialist Task Force (STF555) assessing the impact on existing standards of communications involving IoT devices in all types of emergency situations. Project delivered on time / budget and well received. Ouput published July 2019 as ETSI TR 103 582.
- Provision of standards consultancy services for Samsung Electronics in ETSI including membership of the ETSI Board until November 2014

Technologies covered in patent related work include: 3GPP GSM, UMTS, LTE, 5G NR radio interface technologies (Phy, MAC, RLC, RRC), 3GPP access and core networks (GPRS/UMTS & EPC NAS), IMS. Organisations covered include 3GPP & ETSI.

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Clients served / represented include: ADT, Apple, AT&T, Blackberry, Cradlepoint, DELL, Ericsson, Honeywell, HTC, Huawei, LG, Lenovo, Motorola, Nokia, Oneplus, Oppo, Samsung, Sierra Wireless, Thales, T-Mobile, Sprint, Verizon, Vodafone, Xiaomi, ZTE.

Working with: Addy Hart LLP, Alston & Bird LLP, Baker Botts LLP, Banner Witcoff LLP, DLA Piper LLP, European Telecommunications Standards Institute (ETSI), Fish & Richardson P.C., Gibson Dunn LLP, Haynes and Boone LLP, Hillebrand-CE GmbH, Kirkland & Ellis LLP, K&L Gates LLP, MckoolSmith LLP, PV Law LLP, Paul Hastings LLP, Perkins Coie LLP, Powell Gilbert LLP, Sidley Austin LLP, Samsung Electronics Research & Development Institute UK (SRUK), Taylor Wessing LLP, Williams & Connolly LLP, WilmerHale LLP.

Expert testimony through deposition:

- *Huawei Technologies Co. Ltd. vs. T-Mobile US, Inc., et al.*, Case Nos. 2:16-cv-0052-JRG-RSP, 2:16-cv-0055-JRG-RSP, 2:16-cv-0056-JRG-RSP, and 2:16-cv-0057-JRG-RSP (E.D. Tex.). On behalf of T-Mobile US Inc.
- *T-Mobile US, Inc., et al.* v. *Huawei Technologies Co. Ltd.*, Case Nos. IPR2017-00696 and IPR2017-00697 (PTAB). On behalf of T-Mobile US Inc.
- *LG Electronics, Inc., v. Koninklijke KPN N.V.*, Case No. IPR2018-00558 (PTAB). On behalf of LG Electronics, Inc.
- *Nokia of America Corp. and Ericsson Inc. v. IPCOM, GMBH & Co.,* Case No. IPR2021-00533 (PTAB). On behalf of Ericsson Inc.
- *IPCom, GmbH & Co., Plaintiff, v. AT&T Inc., et al, Defendant, Nokia of America Corp., Intervenor, Ericsson Inc., Intervenor.,* Civil Action No. 2:20-CV-322-JRG*, and IPCom, GmbH & Co., Plaintiff, v. Verizon Communications, et al., Defendant, Nokia of America Corp., Intervenor, Ericsson* nc*., Intervenor.,* Civil Action No. 2:20-CV-323-JRG. On behalf of Ericsson Inc.
- *Ericsson Inc. v. Koninklijke KPN N.V.,* Case No. IPR2022-00069 (PTAB). On behalf of Ericsson Inc.

Expert testimony in court:

- *Between IPCom GmbH and Vodafone, et al.,* Claim No. HP-2018-000030 Claim No. HP-2018-000031, High Court of Justice, Business & Property Courts of England and Wales, Intellectual Property List (ChD), Patents Court. Retained by Vodafone.
- *Between (1) Mitsubishi Electric Corporation (2) Sisvel International SA and Oneplus Mobiletech UK Limited, Oppo Mobile UK Ltd, Xiaomi Technology UK Limited, et al.,* Claim No. HP-2019-000014, High Court of Justice, Business & Property Courts of England and Wales, Intellectual Property List (ChD), Patents Court. Retained by Oneplus, Oppo, and Xiaomi (trial held remotely due to COVID-19 restrictions)

Samsung Electronics Research Institute (SERI) 12/96 – 01/13

Director Standards and Industry Affairs 03/11 – 01/13

Mission and Tasks as for previous role plus:

- Proactive member of ETSI Board following election as Board member in November 2011
- Worked with Samsung internal and external legal counsel in response to EC investigation into Samsung suspected abuse of Standards Essential Patents.
- Deposed by Apple as fact witness in ITC investigation 337-TA-794.

Head of Advanced Technologies Standards & Regulation 09/05 - 03/11

Mission: To help position Samsung and SERI at the forefront of mobile telecommunication developments through participation in and leadership of mobile communications standards and European regulatory affairs

Key tasks:

- Developed standards and research strategy and coordinated activites with head office, acting as official Samsung contact for the European Telecommunications Standars Institute.
- Programme managed standardisation and regulation projects covering 3GPP (RAN2, CT1, SA2, SA1, SA, RAN, CT), OMA, and mobile Broadcast strategies and technologies (DVB Forum), European Framework projects (FP7), Spectrum Management (CEPT, ETSI EM, TFES, BRAN, …) and European Regulatory affairs (Digital Europe, relations with European Commission, …). - Grew department from 3 to 12 persons to cater for these activities.
- Participated and actively contributed to 3GPP SA1 (11/08 – 11/11), SA2 (10/05 – 08/11) , SA and ETSI TC SCP groups on issues including IMS / CS Interworking (VCC / SRVCC, VoLTE, T-ADS, ICS), Local IP Access & Selected IP Traffic Offload (LIPA-SIPTO), MOSAP, M2M/MTC, Embedded / 4FF UICC.
- Drafted and filed communication technology related patents related to 3GPP SA2 and CT1 technologies – 18 filed, mainly IMS and 3GPP NAS related
- Supported Samsung IP team with analysis of Samsung and 3rd party communication technology related patents and claim charts including GSM/GPRS, UTRAN, NAS, and IMS patents
- Chaired SERI Patent Committee from 2007-2009 - SERI achieved patent targets for first time in 2007 and did so in every year following

Standards consultant – part time 09/04 – 09/05

(Whilst studying fulltime for MSC)

During this time, I conducted a review of the wireless communication technolgies and the associated standards space, with a particular emphasis on 802.16a, as well as 3G and 802.11 evolutions. I was also involved in analysis of 3rd party patents and claim charts on request from Samsung IP team.

Technology Manager System Engineering group 06/03 – 09/04

Mission: To establish a System Engineering group within SERI to support development of SERI's dual mode GSM/UMTS radio modem platform.

Key Tasks:

- Defined and implemented System Engineering group strategy including recruitment and line management of the group which grew from 3 to 10 engineers during this period.
- Developed detailed system requirements for SERI's dual mode 2G/3G radio modem platform(s) including production of background documentation describing system wide behaviour
- Defined system test programme for platform, including example test cases using off the shelf test equipment. This project outsourced (under my supervision) to a third party company for completion.
- Provided continued support to development engineers in terms of understanding specification and system requirements, particularly with respect to Access Stratum and Non Access Stratum specifications and protocols.
- Instigated and managed studies investigating optimised system architecture for future Samsung mobile platforms.
- Analysed Samsung and 3rd party 3GPP technology related patents and claim charts on request by Samsung IP team and reported on their value and standards essentiality.

Technology Manager Standards & System Group 04/02 – 06/03

Mission: To provide Standards support to SERI development teams and Samsung's global standardisation activities.

Key Tasks:

- Devised and implemented revised strategy to improve the focus of activities and provide improved support for software developers from a system perspective.

- Attended 3GPP TSG SA plenary and occasional SA WG1 meetings - acted as rapporteur for 3GPP Evolution technical report 3GPP TR 21.902.
- Analysed 3rd party GSM/GPRS technology related patents and claim charts on request by Samsung IP team and reported on their value and standards essentiality.
- Line managed 3 engineers, ensuring that the group provided expert support for SERI SW and HW developers in terms of standards interpretation and system requirements, particularly with respect to the Radio Access Network.

Project Manager 04/00 – 04/02

Mission: To establish and manage development of a dual mode GSM/UMTS modem platform.

Key tasks:

- Defined and managed work relating to core technology development for Samsung's 3G handsets.
- Determined major technical architecture and parameters for the platform producing high level system requirements specification and project development plan.
- As a technical authority on UMTS, supported the project in terms of requirements specification and interpretation (L1, MAC/RLC, RRC, and NAS specifications), and contributed towards the training of UMTS project team members.
- Acting in a consultative capacity, interfaced with other departments in Samsung and with external customers/suppliers on issues relating to 2G and 3G technologies
- Responsible for the overall planning, work allocation and co-ordination of engineers for the project, as well as being involved in recruitment – during this period the number of engineers working on the project increased from 10 to over 40.
- Instigated, defined and managed a feasibility study involving HW and SW engineers, as essential preparation for the development of a dual mode GSM/UMTS radio modem platform.

Senior/Principal Standards Engineer 12/96 – 04/00

Mission: To support Samsung standards and development activities in ETSI and 3GPP.

Key Tasks:

- Gathered and disseminated information throughout Samsung concerning latest specifications and trends in telecommunications, providing advice to Senior Management on future strategies for telecommunications development.
- Acted as sole Samsung representative in ETSI TC SMG2 from December 1996 and during the selection phase for the UMTS Radio Acces Technology providing training for Samsung engineers on elaborated technologies
- Participated in 3GPP TSG RAN WG1 (UTRA Physical Layer), and RAN WG2 (L2/3) contributing specifically in areas related to FEC, Common Packet Channel, and Transmit Diversity
- In 3GPP TSG T WG2 I initiated and acted as rapporteur for the UE capabilities work item. I also acted as liaison officer between TSG T WG2, TSG RAN WG1 and TSG SA WG1 (Service Aspects) on issues of common interest
- Acted as main spokesperson for and advisor on Samsung strategic activities in, 3GPP TSG RAN from 3GPP's creation until April 2000
- Acted in a consultative capacity advising the company on technical, commercial and regulatory issues relating to 3rd generation telecommunications development and implementation.
- Developed and promoted programme to co-ordinate standards activities throughout Samsung. – Samsung Global Standards Strategy Group established in September 1998.
- Attended ETSI TCs, SMG1, SMG4, SMG5, SMG7, SMG9 and SMG11 as required by Samsung to keep abreast of developments prior to establishment of 3GPP

Radiocommunications Agency 06/93 -11/96

HPTO Spectrum Engineer

- Responsible for the management of spectrum for use by PMR and Wireless LAN technologies.
- Defined and instigated development of an improved assignment methodology for Private Mobile Radio (PMR) channels, promoting increased quality and spectrum efficiency.
- Managed research projects involving the assessment and selection of bids from external companies, submitted under competitive tender.
- Represented the Agency in the National and International fora associated with the use of Land Mobile Radio, acting as rapporteur for PMR voice and data standards in ETSI Sub-Technical-Committee RES02, and as chairman of a sub-working group under ITU WP8A drafting the recommendation for use of the radio spectrum by Radio LANs.
- Involved in CEPT Spectrum Engineering Project Teams, dealing with spectrum for Narrow band PMR technology and co-ordination between that technology and T-DAB transmissions in Band III.
- Dispensed technical advice both within the Agency and to external customers, on national and international PMR standards, assessing requests for additional frequencies, and providing technical justification for assignments and wider spectrum policy

BBC Radio 11/89 – 05/93

Radio Operations Engineer

- Worked on projects requiring the design, development, maintenance and testing of equipment for use within the broadcasting chain.
- Responsible for acceptance testing of new studios for Radio 5, and in particular redesign of outside source circuits for the main sports continuity studio.
- Involved in acceptance testing for NICAM transmission routers. Designed and implemented modifications to synchronise transmission feeds, resulting in seamless switching between routers.

Education

1. MSC in Computer Science from the University of Kent

   Awarded (with distinction): 07/2006

   Dissertation title: Roles Variables and Program Analysis – Received prize for outstanding achievement

2. B.Eng. (Hons) in Electronic Engineering from the Polytechnic of Central London

   Awarded: 07/1989

3. In house and external technical and management training including: Learning Tree courses on System Analysis and Design, User Requirements, UML, and Project Management.
4. On-line courses from: Cousera, Udemy, and Zenva courses covering Machine Learning, Python, Data Science, and Natural Language Processing

APPENDIX 2

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THIRD GENERATION PARTNERSHIP PROJECT (3GPP)

PARTNERSHIP PROJECT DESCRIPTION

During the meeting held in Copenhagen, 2 - 4 December 1998 ARIB, ETSI, T1, TTA and TTC agreed this Partnership Project Description.

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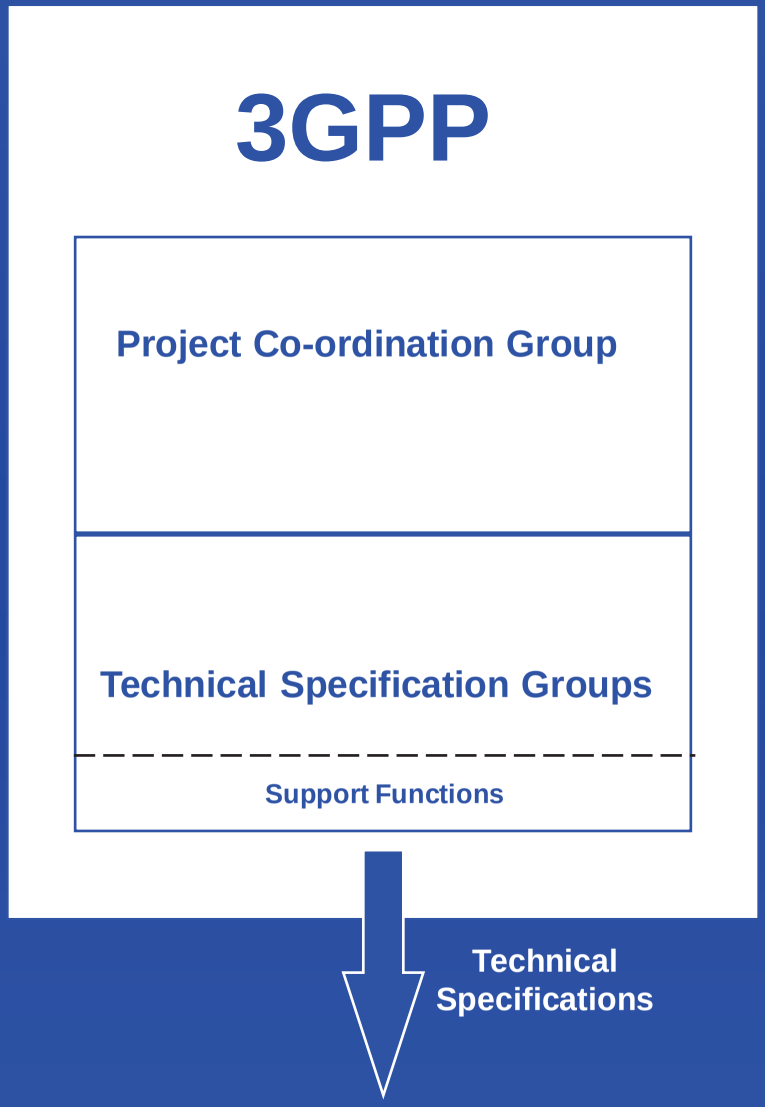
Preamble

Standards organizations and other related bodies have agreed to co-operate for the production of a complete set of globally applicable Technical Specifications for a 3rd Generation Mobile System based on the evolved GSM core networks and the radio access technologies supported by 3GPP partners (i.e., UTRA both FDD and TDD modes).

The Project is entitled the "Third Generation Partnership Project" and may be known by the acronym "3GPP".

3GPP has been established for the preparation and maintenance of the above mentioned Technical Specifications, and is not a legal entity.

3GPP Overview



Definition of the Third Generation Partnership Project

3GPP will provide globally applicable Technical Specifications for a 3rd Generation Mobile System based on the evolved GSM core network, and the Universal Terrestrial Radio Access (UTRA), to be transposed by relevant standardization bodies (Organizational Partners) into appropriate deliverables (e.g., standards).

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Scope and objectives (1)

The Technical Specifications will be developed in view of global roaming and circulation of terminals.

The 3rd Generation Mobile System and its capabilities will be developed in a phased approach. Initially, 3GPP will elaborate, approve and maintain the necessary set of Technical Specifications for the first phase of a 3rd Generation Mobile System including:

- **UTRAN (including UTRA; W-CDMA in Frequency Division Duplex (FDD) mode and TD-CDMA in Time Division Duplex (TDD) mode)**
- **3GPP Core Network (Third Generation networking capabilities evolved from GSM . These capabilities include mobility management and global roaming.)**
- **Terminals for access to the above (including specifications for a UIM)**
- **System and service aspects**

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Scope and objectives (2)

The set of global specifications for the first phase of the 3GPP core network and the specifications for the GSM core network should be common to the largest extent possible and should not be needlessly different.

The results of the 3GPP work will form the basis of member contributions to the ITU in accordance with existing procedures.

3GPP will take account of emerging ITU recommendations on interworking between IMT-2000 family members.

In the framework of agreed relationships, 3GPP will elaborate Technical Specifications that will form the basis of standards, or parts of standards, of the Organizational Partners.

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Characteristics of 3GPP (1)

3GPP is characterized by the following attributes:

- **Minimum production time for Technical Specifications from conception to approval**
- **Fast, electronic based approval process**
- **Maximum use of modern (electronic) working methods**
- **Minimum number of hierarchical levels with decision making taking place at the lowest appropriate levels**

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Characteristics of 3GPP (2)

- **A Project Co-ordination function and a Technical Specification function**
- **Task oriented, ensuring that on completion of the tasks the future of the project is re-evaluated**
- **Cost effective use of financial/human resources provided by Partner Organizations (if required)**

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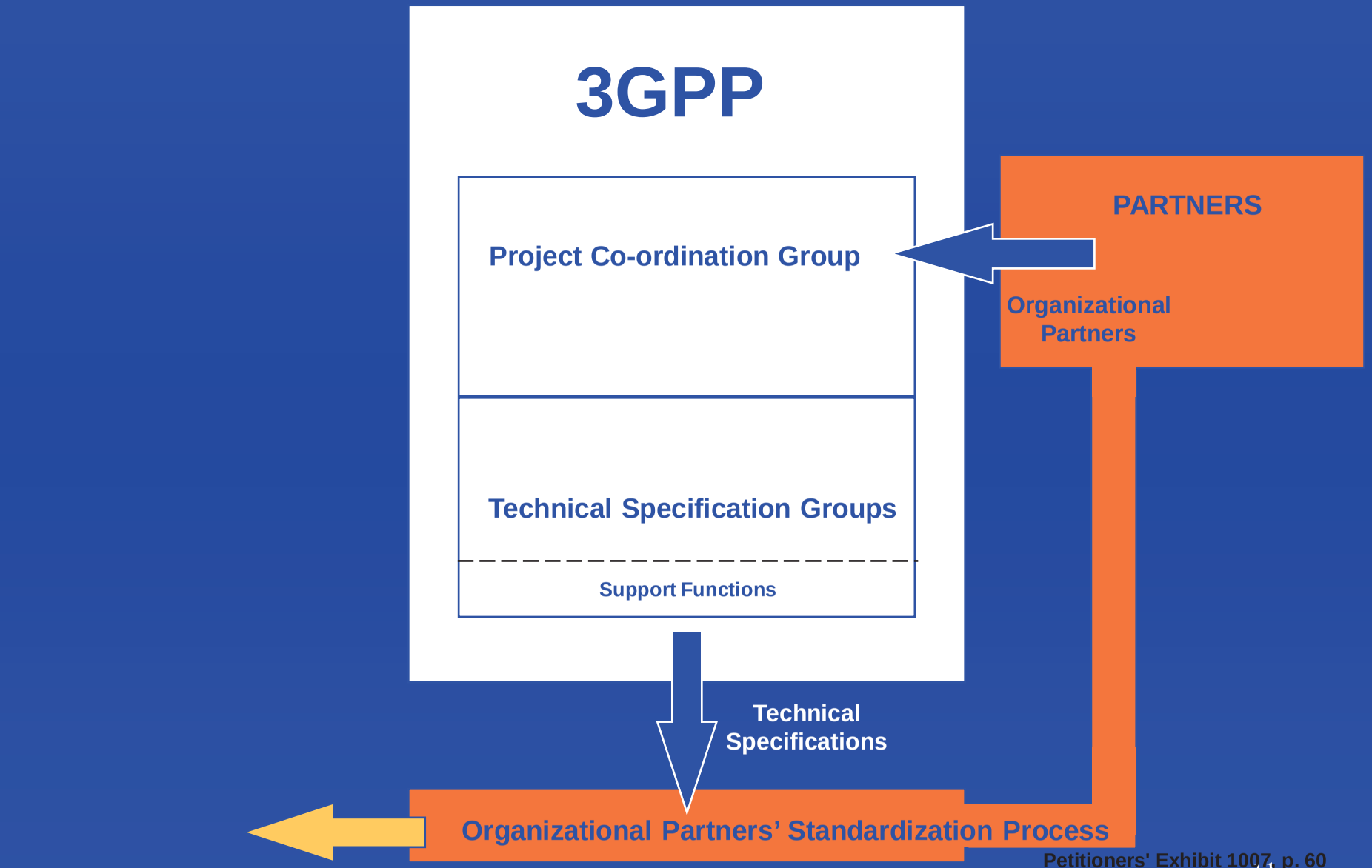
Partnership and Membership

3GPP comprises of:

- **Partners:**
  - **Organizational Partners**
    - **3GPP is open to all standards organizations irrespective of the geographical location.**
  - **Market Representation Partners**
- **Individual Members**

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Organizational Partners (1)



Organizational Partners (2)

An Organizational Partner is:

An open standards organization with a national, regional or other officially recognized status (in their country or region)

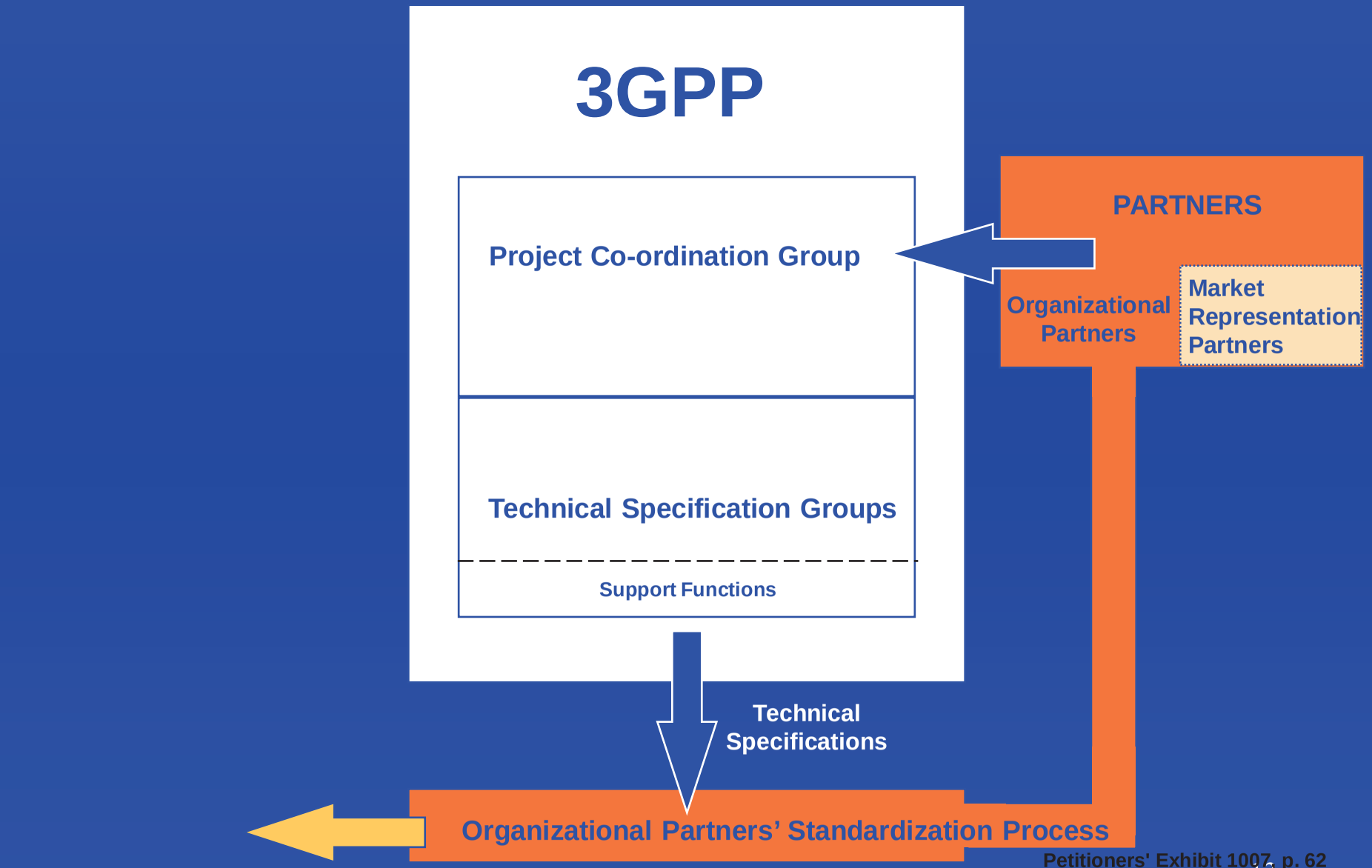
that:

- **has the capability and authority to define, publish and set standards nationally or regionally and**
- **has signed (or whose sponsor has signed) the Partnership Project Agreement**

Organizational Partners will meet as approriate and make decisions by consensus.

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Market Representation Partners (1)



Market Representation Partners (2)

Standardization should meet market needs.

In order to identify market requirements, the high competence of Market Representation Partners should be used.

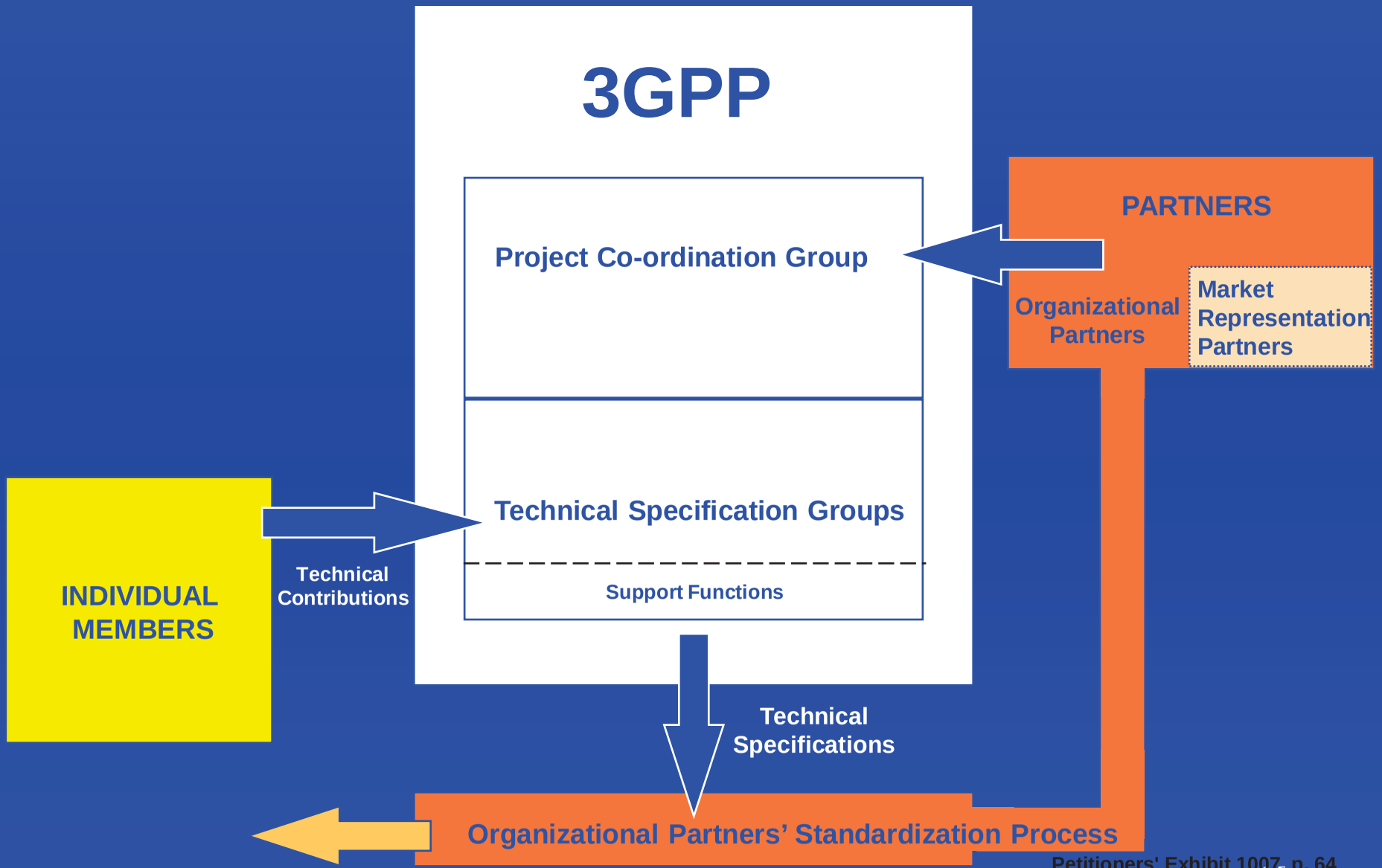
A Market Representation Partner is an organization invited to participate by the Organizational Partners to offer market advice to 3GPP and to bring into 3GPP a consensus view of market requirements (e.g. services, features and functionality) falling within the 3GPP scope.

A Market Representation Partner:

- **does not have the capability and authority to define, publish and set standards nationally or regionally**
- **has signed (or whose sponsor has signed) the Partnership Project Agreement**
- **has committed itself to the 3GPP scope**

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Individual Members (1)



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Individual Members (2)

Membership in an Organizational Partner is a pre-requisite for Individual Membership in 3GPP.

Individual Membership is open to legal entities committed to support 3GPP and to:

- **contribute technically or otherwise to one or more of the Technical Specification Groups within the 3GPP scope**
- **use the 3GPP results to the extent feasible**

Individual Membership in 3GPP will be terminated by dissolution, abolition, resignation or expulsion from the related Organizational Partner.

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Individual Members (3)

All entities registered as members of an Organizational Partner and eligible for participation in the technical work of that Partner, can become Individual Members of 3GPP. Individual members shall apply to their Organizational Partner to participate in 3GPP.

Individual Members act in the 3GPP in their own right; they carry the full responsibility for their contributions.

Individual Membership applicants residing in a country/area without an Organizational Partner can apply for membership in an Organizational Partner according to the rules of each Partner. (e.g. ETSI Associate Membership is available)

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Observership

In order to ensure globally applicable Technical Specifications, the status of "Observer" may be granted by the Organizational Partners to an entity which has the qualifications to become a future Organizational Partner. The status of "Observer" includes obligations to:

- **identify as early as possible any regulatory requirements that may lead to options within Technical Specifications**
- **make their IPR policy available for consideration**
- **contribute to the common objective of the 3GPP and avoid duplication of work related to the 3GPP**

The participation rights of an Observer will be decided on a case by case basis.

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3GPP-04/12/1998

Documentation for 3GPP

The following 3 documents describe 3GPP:

- **The Partnership Project Agreement**
- **The Partnership Project Description (this present document)**
- **The Partnership Project Working Procedures**

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The Partnership Project Agreement (1)

The Partnership Project Agreement is a concise legal document signed by participating Partners (or their sponsor).

It contains the minimum legal text necessary for 3GPP to function correctly.

The Partnership Project Agreement refers to the Partnership Project Description and the Partnership Project Working Procedures.

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The Partnership Project Agreement (2)

The Partnership Project Agreement includes obligations on Organizational Partners to commit themselves to the 3GPP scope:

- **to encourage their members to contribute to the common set of Technical Specifications and to avoid duplication of work**
- **to convert / transpose / adopt all relevant Technical Specifications resulting from 3GPP into their own relevant deliverables through their normal processes**
- **to identify as early as possible, any national / regional regulatory requirements that may lead to options within the Technical Specifications**
- **to make their IPR Policy available for consideration**

The Partnership Project Agreement (3)

The Partnership Project Agreement includes obligations on Market Representation Partners to identify market and service requirement of 3GPP and to contribute to:

- **the promotion of 3GPP**
- **the definition of 3GPP System and Service scenarios**

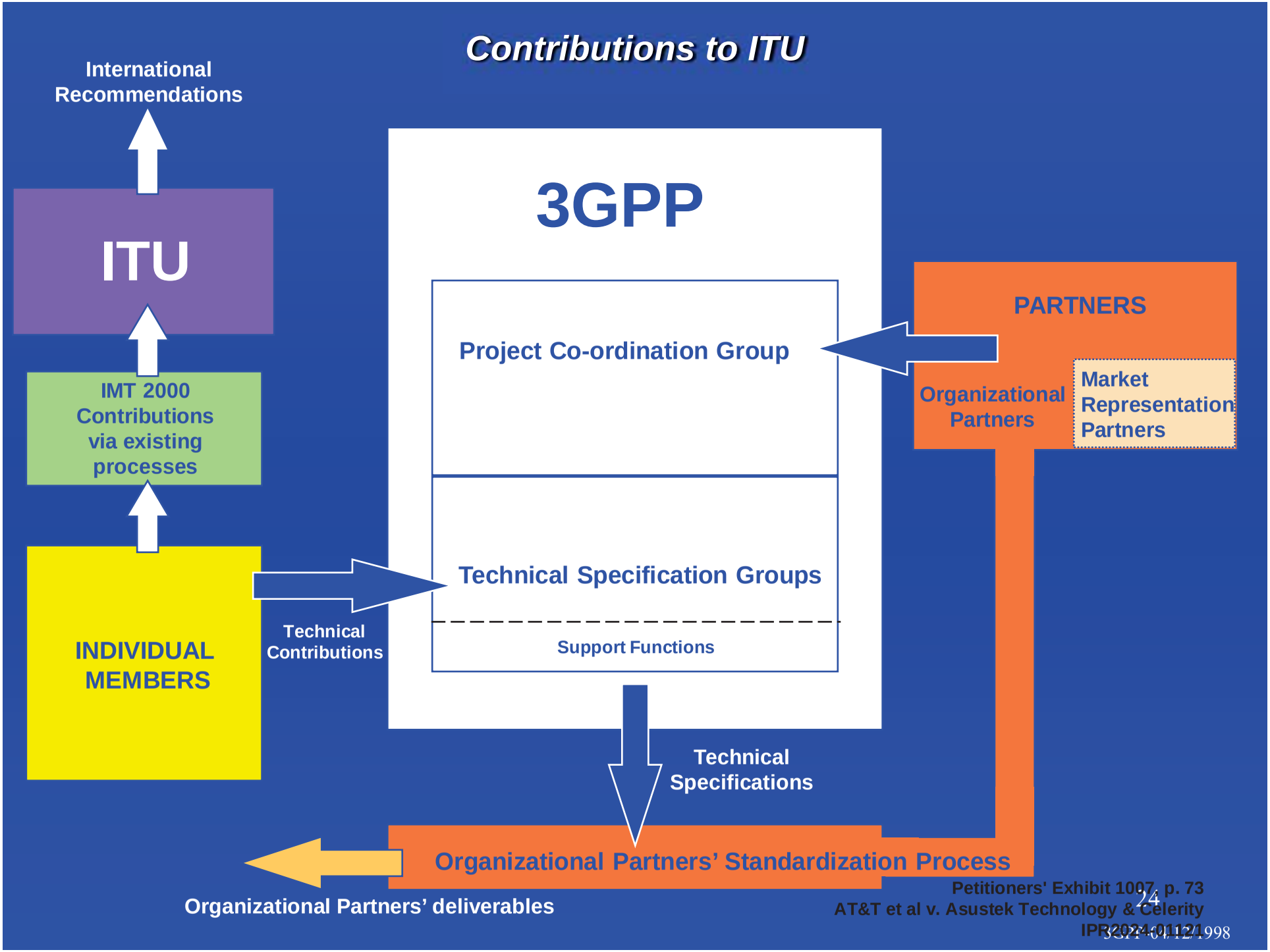
The Market Representation Partners should also encourage their members to contribute to the common objectives of 3GPP and to avoid duplication of work.

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Ownership of the Partnership Project results

The Organizational Partners of 3GPP will have joint ownership (including copyright) of the Technical Specifications.

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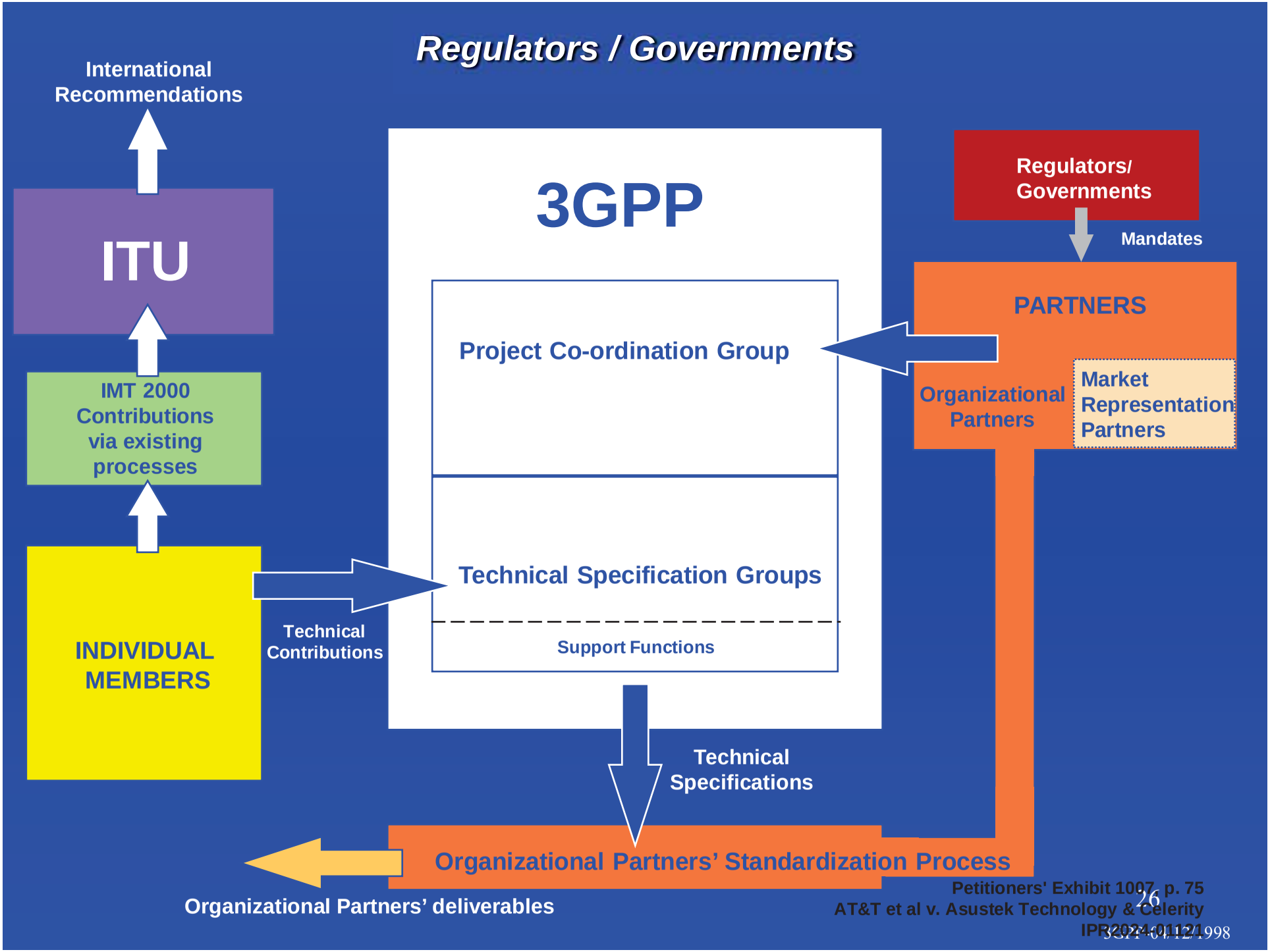

Contributions to ITU
International Recommendations
ITU
IMT 2000 Contributions via existing processes
INDIVIDUAL MEMBERS
Technical Contributions
3GPP
Project Co-ordination Group
Technical Specification Groups
Support Functions
PARTNERS
Organizational Partners
Market Representation Partners
Technical Specifications
Organizational Partners' Standardization Process
Organizational Partners' deliverables

Submission of 3GPP results to ITU

3GPP will not contribute directly to the ITU.

Formal contributions to ITU Study Groups are made by ITU members following existing national/regional processes.

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Regulators / Governments
International Recommendations
ITU
IMT 2000 Contributions via existing processes
INDIVIDUAL MEMBERS
3GPP
Project Co-ordination Group
Technical Specification Groups
Support Functions
Technical Contributions
Technical Specifications
Regulators/ Governments
Mandates
PARTNERS
Organizational Partners
Market Representation Partners
Organizational Partners' Standardization Process
Organizational Partners' deliverables

National / regional regulatory requirements

Variations imposed by national / regional regulatory requirements will be included in the Technical Specifications as defined by the Technical Specification Groups.

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Resource requirements for establishing 3GPP

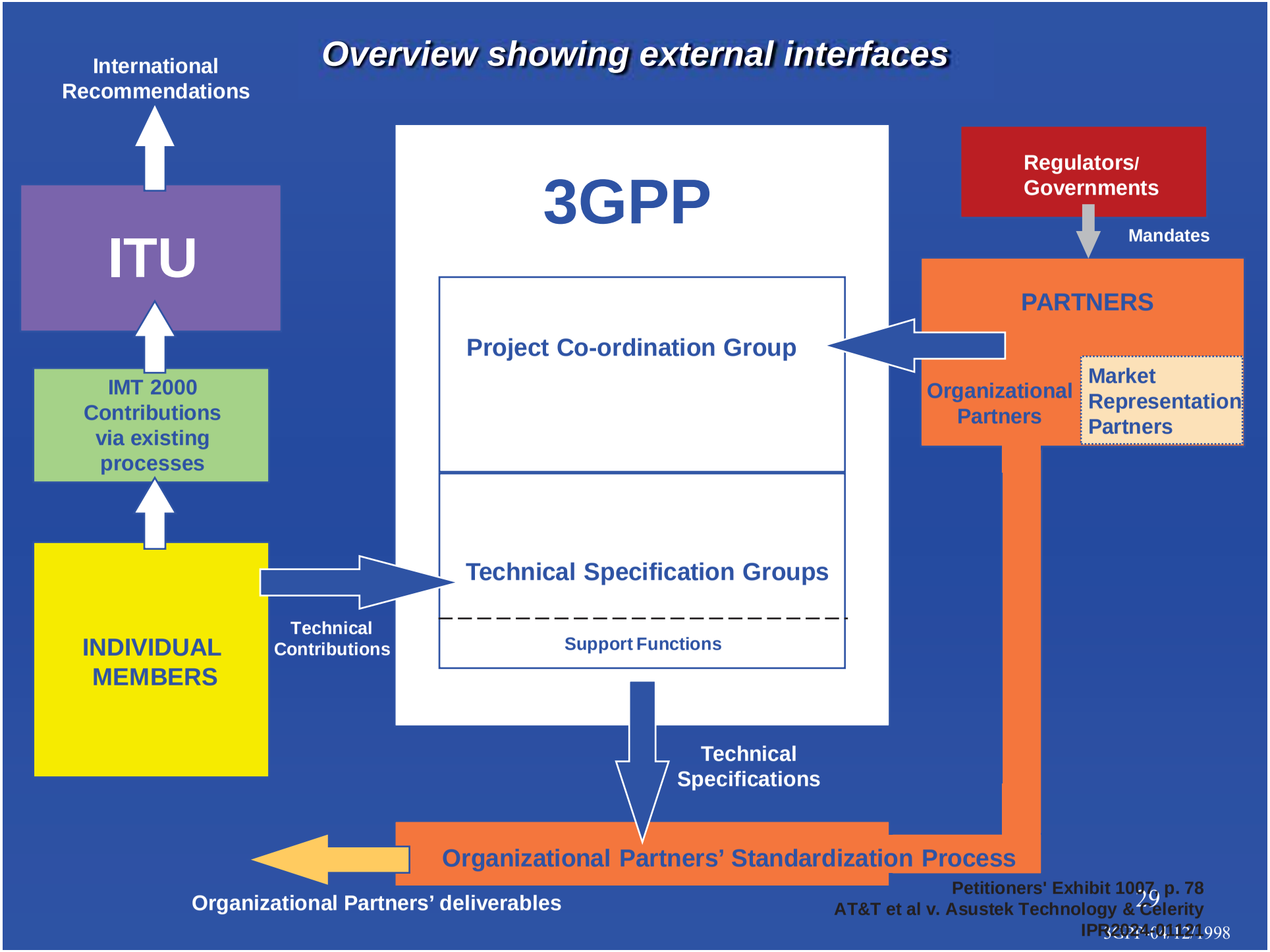
ETSI will absorb the initial cost of establishing the 3GPP, if required.

Thereafter, the costs will be shared by the Organizational Partners. There will be no direct 3GPP membership fee for Individual Members.

Partners and Individual Members may provide support functions to the extent that they are able (eg hosting of meetings and provision of Secretariat support).

The longer term financial requirements are for further study.

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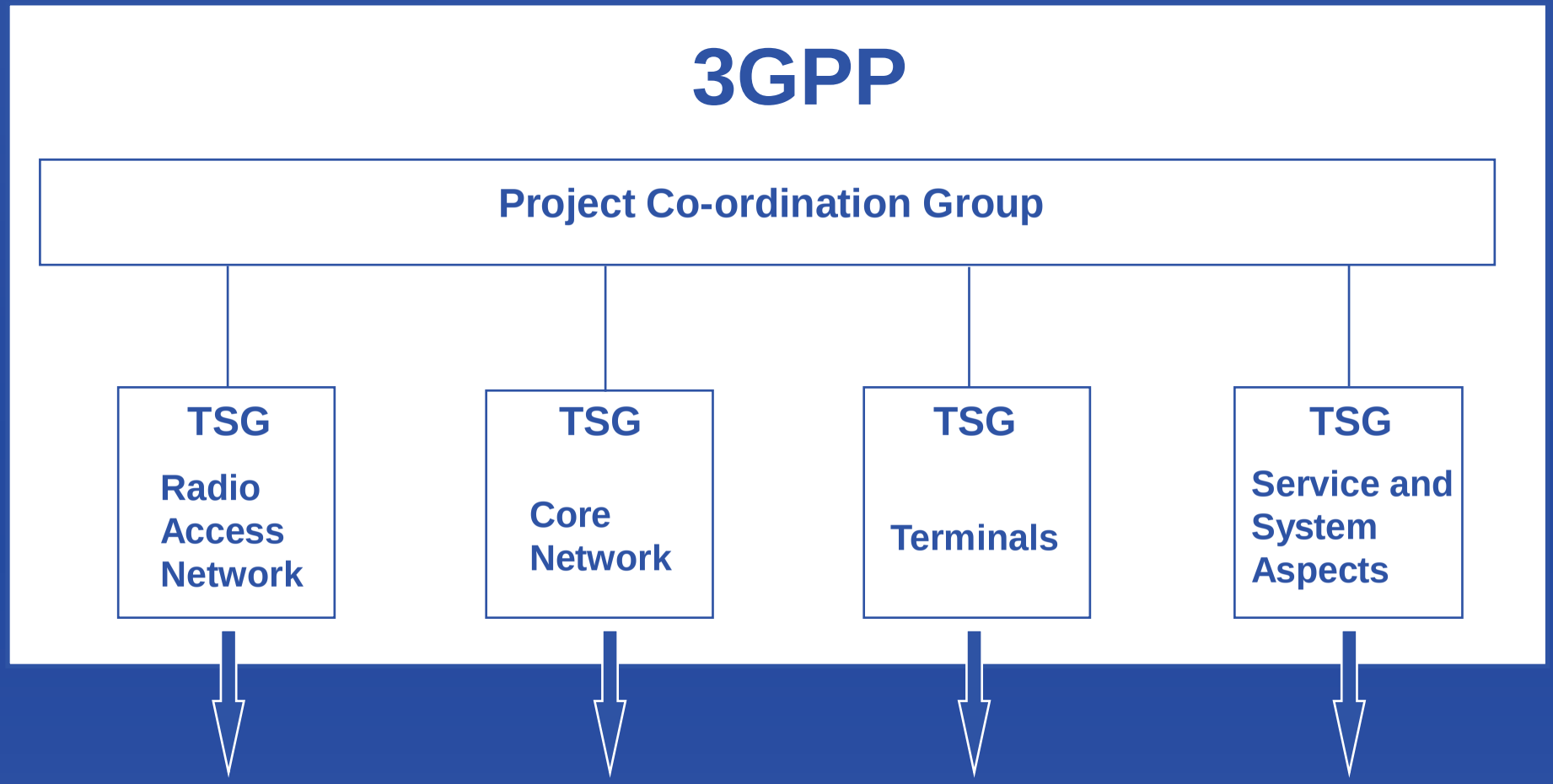
Internal structure of 3GPP (1)

3GPP consists of a Project Co-ordination Group (PCG) and Technical Specification Groups (TSGs).

To assist in the co-ordination of the technical activities, the TSGs are encouraged to meet at the same time and place, as and when appropriate (e.g. twice per year).

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Internal structure of 3GPP (2)



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Work areas to be covered by the Radio Access Network TSG

- Radio Layer 1 specification
- Radio Layer 2 specification
- Radio Layer 3 RR specification
- Iub specification
- Iur Interface
- Iu Interface
- UTRAN O&M requirements
- Base station radio performance specification
- Conformance test specification for testing of radio aspects of base stations
- Specifications for radio performance aspects from the system point of view

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Work areas to be covered by the Core Network TSG

- **Mobility management, call connection control signalling between the user equipment and the core network**
- **Core network signalling between the core network nodes. the signalling supports functionality such as user location information, subscription information and control of network services**
- **Definition of interworking functions between the core network and external networks**
- **Packet related questions such as mapping of QoS (e.g. transparency for IP domain applications, general for bearer types, special for optimized applications such as Voice over IP)**
- **Core network aspects of the lu interface**
- **Core network O&M requiremnents**

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Work areas to be covered by the Terminal TSG

- **Service capability protocols**
- **Messaging**
- **Services end-to-end interworking**
- **USIM to Mobile Terminal interface**
- **Model/framework for terminal interfaces and services (application) execution**
- **Conformance test specifications of terminals, including radio aspects**

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Work areas to be covered by the Service and System Aspects TSG

- **Service capabilities**
  - **Definition of services and feature requirements**
  - **Development of service capabilities and a service architecture for cellular, fixed (and cordless) applications**
- **Stage one and two descriptions for:**
  - **Charging and accounting**
  - **Network Management**
  - **Security Aspects**
- **Architecture**
  - **Definition, evolution, and maintenance of overall architecture, including assignment of functions to particular sub-systems and identification of key information flows**
  - **In co-operation with other TSGs, define required services, service capabilities and bearer capabilities offered by the different sub-systems**
- **Codec aspects**
  - **Principles for definition of end-to-end transmission**
  - **Definition, evolution and maintenance of relevant specifications**
- **Project co-ordination**
  - **High level co-ordination of the work performed in other TSGs and monitoring of progress**

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Primary responsibilities of PCG and TSGs (1)

The primary responsibilities of PCG, TSGs and Organizational Partners are given in the following tables:

	Function	Org Partners collectively	PCG	TSGs
1	Approval of new Partners for 3GPP	X		
2	Approval of Organizational Partner funding requirements and contributions	X		
3	Allocation of human and financial resources provided by Partners to PCG	X		
4	Allocation of resources to TSGs		X	
5	Allocation of resources within TSGs			X

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Primary responsibilities of PCG and TSGs (2)

	Function	Org Partners collectively	PCG	TSGs
6	Allocation of voluntary human and financial resources by Market Representation Partners and Individual Members		X	X
7	Handling of appeals from Individual Members on procedural matters	2nd step	1st step	
8	Handling of appeals from Individual Members on technical matters		2nd step	1st step
9	Determine overall time frame and manage overall work progress		X	

Primary responsibilities of PCG and TSGs (3)

	Function	Org Partner collectively	PCG	TSGs
10	Detailed time frame and manage detailed work progress			X
11	Approval of Technical Specifications			X
12	Proposal and approval of work items within the agreed scope and terms of reference			X
13	Final adoption of work items within the agreed scope and terms of reference		X	
14	Management of work items			X

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Primary responsibilities of PCG and TSGs (4)

	Function	Org Partners collectively	PCG	TSGs
15	Technical Co-ordination (System Aspects TSG will play a role here)			X
16	Appointment of Org Partners meeting Chairman (provided by host on a rotational basis)	X		
17	Appointment of PCG Chairman (for one year term)		X	
18	Election of TSG Chairman and Vice Chairmen			X
19	Creation of TSGs and approval of their terms of reference	X		

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Primary responsibilities of PCG and TSGs (5)

	Function	Org Partners collectively	PCG	TSGs
20	Creation of TSG working groups and approval of their terms of reference			X
21	Election of TSG Working Group Chairmen and Vice Chairmen			X
22	Confirmation of individual member participation rights	X		
23	Approval of 3GPP scope and terms of reference	X		
24	Maintain Partnership Project Agreement, Project Description and Working Procedures (consensus agreement by all Partners)	X		

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Participation rights in PCG and TSGs

The following have a right to participate in the PCG:

- **Representatives of participating Organizational Partners**
- **Representatives of participating Market Representation Partners**
- **Chairman and Vice Chairmen of the TSGs, as ex-officio members**

The following have a right to participate in the TSGs :

- **Representatives of members of participating Organizational Partners (i.e. Individual Members)**
- **Representatives of participating Organizational and Market Representation Partners**

Principles for decision making within 3GPP

Decision making within PCGs

- **By consensus amongst the Organizational Partners**
- **By vote amongst the Organizational Partners in unavoidable cases**

Decision making within TSGs

- **By consensus amongst the Individual Members**
- **By vote amongst the Individual Members in unavoidable cases**

The Organizational Partners will conduct a fairness review of the decision making process six months after 3GPP start-up, taking into account all concerns raised

(Note: voting will not be permitted on National/Regional regulatory requirements)

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Principles for voting within TSGs

The following principles will be applied for voting within the TSGs

- **One "Individual company Member", one vote**
- **Organizational Partners to interpret " Individual company Member" according to its own rules of membership**
- **The PCG will maintain a register of eligible voters for the TSGs**
- **Each Individual Member may carry the proxy for up to five other Individual Members**

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Working language for 3GPP

The working language for 3GPP shall be English

- **Meetings of the PCG and TSGs shall be conducted in English**
- **3GPP Technical Specifications shall be prepared in English**

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Relationship with other groups

3GPP will establish and maintain good relationships with groups working on standards for other IMT-2000 family members.

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Intellectual Property Rights (IPR) Principles (1)

The Individual Members of 3GPP are bound by the IPR Policies of their respective Organizational Partner.

Individual Members are encouraged to declare at the earliest opportunity, any IPRs which they may have and believe to be essential, or potentially essential, to any work ongoing within 3GPP.

After comparing their respective IPR policies, ARIB, ETSI, T1, TTA and TTC have agreed that their IPR policies share common principles are quite similar and have agreed on the following additional principles to maximize the success of 3GPP.

Intellectual Property Rights (IPR) Principles (2)

(i) **To encourage their respective members' declaration of willingness to grant licences on fair, reasonable terms and conditions on a non-discriminatory basis, and consistent with the respective Organizational Partners' IPR policies.**

(ii) **To encourage their respective members who may have IPR which they believe to be essential, or potentially essential, and are unwilling to license such IPR, that early indication of such unwillingness be provided to their respective Organizational Partners.**

(iii) **To understand that essential IPRs mean essential IPRs relative to any or all parts of the content of the 3GPP technical specifications.**

(iv) **A mechanism for exchanging information associated with the patent statement among the Organizational Partners will be introduced so that such information may be used when adopting relevant standards in each Partner Organization.**

APPENDIX 3

Introducing 3GPP



The 3rd Generation Partnership Project (3GPP) unites seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as “Organizational Partners” providing their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.

3GPP specifications cover cellular telecommunications technologies, including radio access, core network and service capabilities, which provide a complete system description for mobile telecommunications. The 3GPP specifications also provide hooks for non-radio access to the core network, and for interworking with non-3GPP networks

The Project’s Scope

The original scope of 3GPP (1998) was to produce Technical Specifications and Technical Reports for a 3G Mobile System based on evolved GSM core networks and the radio access technologies that they support (i.e., Universal Terrestrial Radio Access (UTRA) both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes).

The scope was subsequently amended to include the maintenance and development of the Technical Specifications and Technical Reports for evolved 3GPP technologies, beyond 3G.

- The latest 3rd Generation Partnership Project Agreement (Annex 42).
- The discussions that led to the signing of the 3GPP Project Agreement were recorded in a series of slides called the “Partnership Project Description” that describes the basic principles and ideas on which the project is based. The document has not been maintained since its first creation, but the principles within do still remain valid.

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Organizing the work

The 3GPP Working Procedures are the rule book of 3GPP, with sections covering:

- Description, Purpose, Scope and objectives
- Participation
- Structure
- Partners' collective responsibilities
- Project Coordination Group (PCG)
- Technical Specification Groups (Incl. Elections)
- Work Programme & technical co-ordination
- Deliverables (Technical Specifications and Technical Reports)
- Reporting

The 3GPP production of specifications and studies (TRs) are contribution-driven, by member companies, in Working Groups and at the Technical Specification Group (TSG) level. The Technical Specification Groups in 3GPP are:

- Radio Access Networks (RAN)
- Services & Systems Aspects (SA)
- Core Network & Terminals (CT)

The Working Groups, within the TSGs, meet regularly and come together for their quarterly TSG Plenary meeting, where their work is presented for information, discussion and approval. The last meeting of the week of TSG Plenary meetings is TSG SA, which also has responsibility for the overall coordination of the technical work and for the monitoring of its progress.

Generational Approach

The 3GPP technologies from these groups are constantly evolving through Generations of commercial cellular / mobile systems (see table below). With LTE and 5G work, 3GPP has become the focal point for the vast majority of mobile systems beyond 3G.

Although these Generations have become an adequate descriptor for the type of network under discussion, real progress on 3GPP standards is measured by the milestones achieved in particular Releases. New features

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are 'functionality frozen' and are ready for implementation when a Release is completed. 3GPP works on a number of Releases in parallel, starting future work well in advance of the completion of the current Release. Although this adds some complexity to the work of the groups, such a way of working ensures that progress is continuous & stable.

Backward Compatibility

The major focus for all 3GPP Releases is to make the system backwards and forwards compatible where possible, to ensure that the operation of user equipment is uninterrupted.

For 5G, many operators are starting with dual connectivity between LTE and 5G NR equipment – using the 'Non-Standalone' work completed early in Release 15. In the process of completing the early drop of 5G NR care has been taken to build 'forward compatibility' into Non-Standalone NR equipment, to ensure that it will be fit for use on Standalone 5G NR systems.

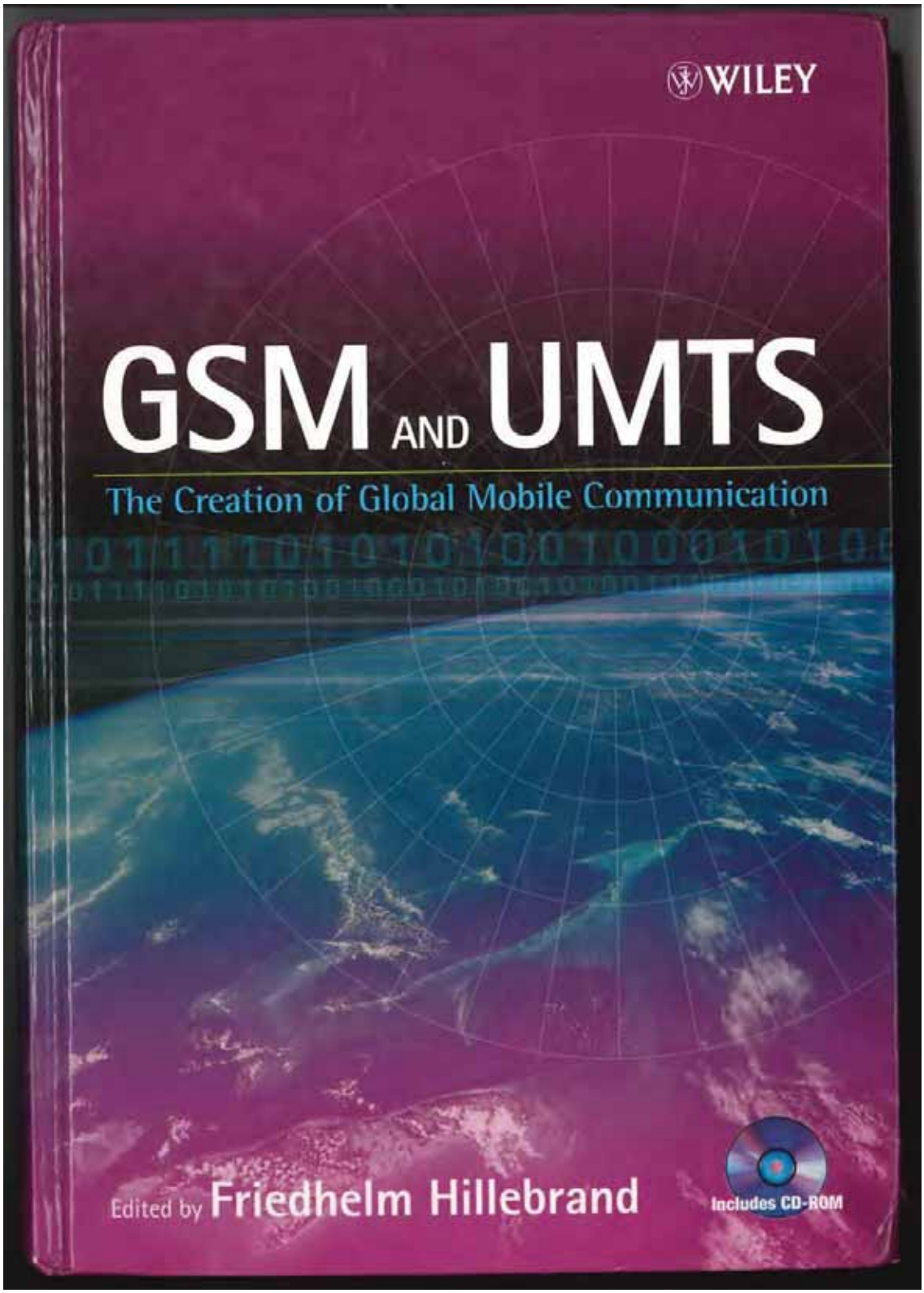
For details of the contents of each Release, see the appropriate 'Release Description' document or go to our dedicated Release page.

Details of all 3GPP Work Items are in the 3GPP Work Plan, which provides details of the cooperation between all of the 3GPP groups on "Features", defined as 'new or substantially enhanced functionality which represents added value to the existing 3GPP system'.

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APPENDIX 4



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GSM and UMTS

The Creation of Global Mobile Communication

Edited by

Friedhelm Hillebrand
Consulting Engineer, Germany

With contributions from 37 key players involved in the work for GSM and UMTS



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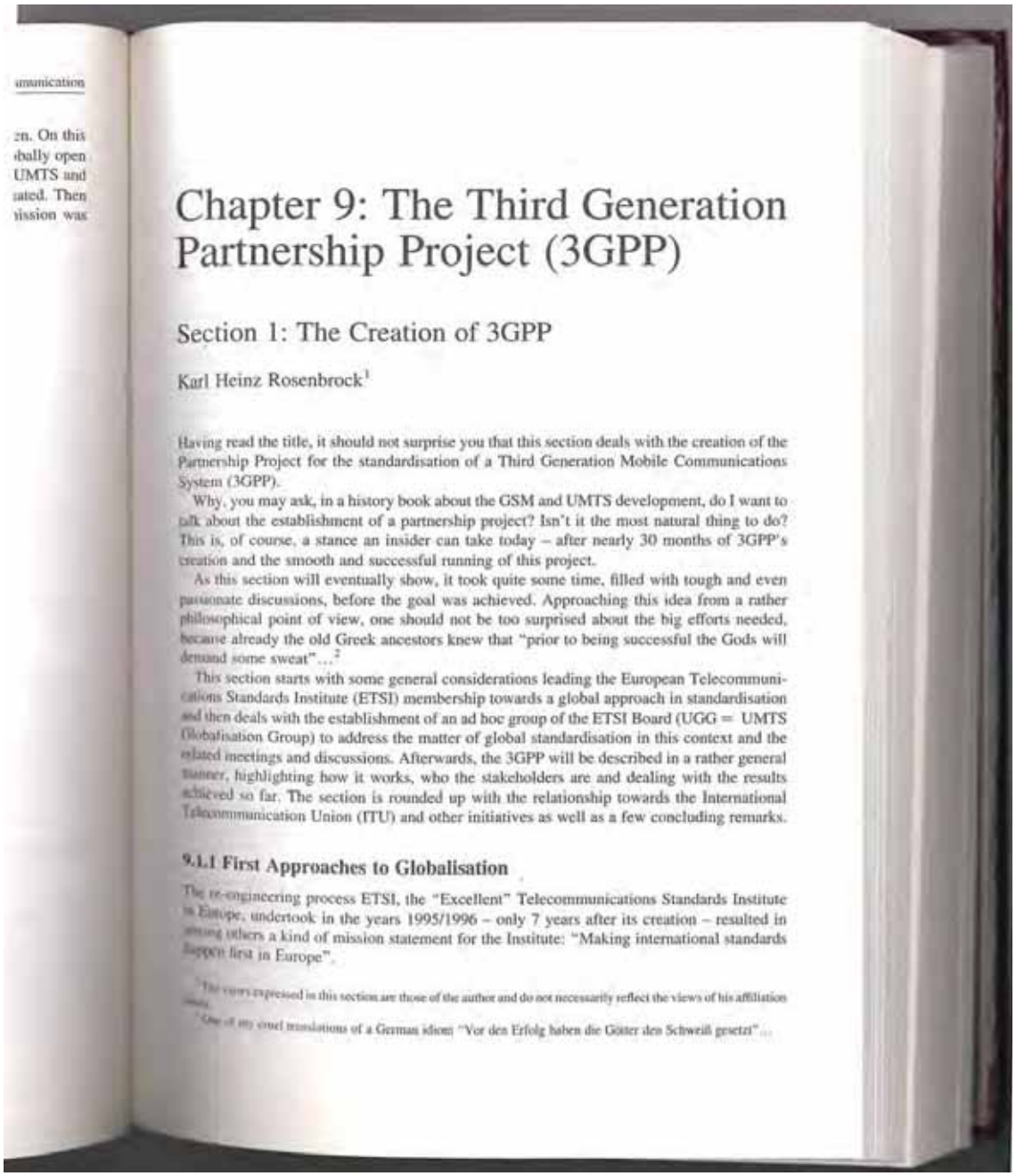
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Chapter 9: The Third Generation Partnership Project (3GPP)

Section 1: The Creation of 3GPP

Karl Heinz Rosenbrock[1]

Having read the title, it should not surprise you that this section deals with the creation of the Partnership Project for the standardisation of a Third Generation Mobile Communications System (3GPP).

Why, you may ask, in a history book about the GSM and UMTS development, do I want to talk about the establishment of a partnership project? Isn't it the most natural thing to do? This is, of course, a stance an insider can take today – after nearly 30 months of 3GPP's creation and the smooth and successful running of this project.

As this section will eventually show, it took quite some time, filled with tough and even passionate discussions, before the goal was achieved. Approaching this idea from a rather philosophical point of view, one should not be too surprised about the big efforts needed, because already the old Greek ancestors knew that "prior to being successful the Gods will demand some sweat"...[2]

This section starts with some general considerations leading the European Telecommunications Standards Institute (ETSI) membership towards a global approach in standardisation and then deals with the establishment of an ad hoc group of the ETSI Board (UGG = UMTS Globalisation Group) to address the matter of global standardisation in this context and the related meetings and discussions. Afterwards, the 3GPP will be described in a rather general manner, highlighting how it works, who the stakeholders are and dealing with the results achieved so far. The section is rounded up with the relationship towards the International Telecommunication Union (ITU) and other initiatives as well as a few concluding remarks.

9.1.1 First Approaches to Globalisation

The re-engineering process ETSI, the "Excellent" Telecommunications Standards Institute in Europe, undertook in the years 1995/1996 – only 7 years after its creation – resulted in among others a kind of mission statement for the Institute: "Making international standards happen first in Europe".

[1] The views expressed in this section are those of the author and do not necessarily reflect the views of his affiliation [illegible].

[2] One of my cruel translations of a German idiom "Vor den Erfolg haben die Götter den Schweiß gesetzt"...

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- unanimously requested the ETSI Board (through its UMTS Globalisation Group) to complete the negotiations with potential partners and to oversee the creation of the Partnership Project;
- unanimously requested the ETSI Board to agree and maintain on behalf of ETSI the final versions of the Partnership Project Description, the Partnership Project Working Procedures, and the Partnership Project Agreement;
- unanimously authorised the director-general to sign the Partnership Project Agreement.

9.1.2.4.14 Happy End in Copenhagen

It was in Copenhagen where the last 3GPP preparatory meeting with all six OPs took place on 2–4 December 1998.

Here, the final fine-tuning of the 3GPP documentation was achieved. In addition, the 3GPP agreement[8] was signed (in a nice framework provided by the host, TeleDenmark) by the following OPs: ARIB, ETSI, T1, TTA, and TTC.

Unfortunately, the partners from CWTS (China) were not authorised to sign the 3GPP agreement yet. Furthermore, owing to the fact that the UMTS Forum was unable to participate in Copenhagen, they were prevented from co-signing the 3GPP agreement as a first Market Representative Partner (MRP).

During that Copenhagen meeting, another discussion ensued about the role the MRPs should play. Finally, it was concluded that the high competence of MRPs should be used in order to identify market requirements, thus enabling 3GPP standardisation to meet the needs of the market. An MRP is an organisation invited by the OPs to participate in 3GPP with the objective of offering market advice to 3GPP and to bring into 3GPP a consensus view of market requirements.

9.1.3 What is 3GPP?

The 3GPP is a global standardisation initiative created in December 1998. Its task was to develop a complete set of globally applicable Technical Specifications for a third generation (3G) mobile telecommunications system based on the evolved GSM core network and an innovative radio interface known as UTRA. The Project is based on a concept devised by ETSI aimed at facilitating better co-operation between regional standards organisations, fora and other industry groupings. 3GPP is a collaborative activity between officially recognised SDOs, with the participation of other industry groups and individual members.

Partnership in 3GPP is open to all national, regional or other SDOs, irrespective of their geographical location – within the project the participating SDOs are referred to as OPs. The OPs may invite MRPs to participate: these may be any organisation from anywhere in the world that can offer market advice to 3GPP and bring a consensus view of market requirements that fall within the project's scope. Individual membership is open to companies and organisations within the communications industry that are active members of one of the OPs. The truly global nature and the breadth of the market interest in the task of specifying this 3G system is evident from the identity of the 3GPP partners (see further in sub-paragraph 9.1.3.2) and all agree that 3GPP is proving a highly successful initiative.

[8] The 3GPP Agreement and the 3GPP Project Description can be found on the attached CD-ROM in

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The 3GPP has no legal status. Ownership (including copyright) of the specifications and reports it produces is shared between the partners. The 3GPP process includes a conversion (transposition) of the project's output into official standards and reports by one or more of the OPs.

The specifications being prepared by 3GPP are evolved in part from the enormously successful GSM standard, which is currently (February 2001) serving over 400 million subscribers in more than 140 countries. Building on this massive installed base, the system being specified by 3GPP will be an attractive upgrade path for existing operators and users. It also has an assured compatibility with GSM – good news for both operators and users who are unable, or unwilling, to upgrade to 3G.

Paramount among the 3GPP specifications is the definition of UTRA, the innovative radio access technology that is the key to the new system's high data rates and dramatically improved performance. UTRA is spectrum-efficient and supports FDD and TDD modes. This interface has been accepted by ITU as a member of the IMT-2000 family – or more correctly, as *two* family members: IMT-DS, the FDD mode; and IMT-TC, the TDD mode. IMT-2000 family membership requires the ability for users to roam globally and seamlessly, which implies interoperability with other family members: 3GPP thus co-operates closely with the 3GPP2 project which is specifying another family member, a 3G CDMA system based on an evolution of the ANSI-41 architecture.

9.1.3.1 How Does 3GPP Work?

3GPP has been designed to minimise delays and inefficiencies. As a result, it has a "flat" organisational structure and a large degree of distributed autonomy. Overall project planning and co-ordination is the responsibility of the PCG, with input primarily from the OPs, guided by the MRPs. It is mainly at this level that regulatory requirements, provided by the telecommunications administrations and governments around the world, are taken into account.

The development of the specifications is performed by TSGs and their subordinate working groups. Here, the main participation is by technical experts from the individual members of the OPs. Individual members in their capacity as ITU members are also responsible for carrying the results of the 3GPP work to the ITU.

At the time of the creation, 3GPP had structured around four principal aspects of the 3G system being defined as TSGs:

- TSG CN: core network
- TSG RAN: radio access network
- TSG SA: services and systems aspects
- TSG T: terminals

Each TSG is authorised to develop and approve specifications and reports within its scope, and TSG SA also has a role of co-ordinating the work of the TSGs at a more detailed level than the PCG. The result is a process that is able to rapidly produce and approve specifications and reports in response to the needs of the market, although it is important to note that the deliverables do not have a formal status until they have been transposed by one or more of the OPs.

The formal status is necessary for regulatory and other purposes in the various regions, and so the OPs have committed themselves to complete this process rapidly. Each OP will apply

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its own procedures, appropriate to their respective regions. As the official European SDO within 3GPP, ETSI recognises the 3GPP output as ETSI Technical Specifications and ETSI Technical Reports without a need for any further endorsement within the Institute. This means that the 3GPP documents are published – within a matter of a few weeks – as identical text directly as ETSI deliverables. In addition, ETSI is transposing, i.e. adapting, a few of the initial 3GPP specifications into ENs for specific European regulatory requirements. This is happening in parallel with the publication of the initial Technical Specifications and will not impede the implementation of 3G in Europe.

9.1.3.1.1 Electronic Working

3GPP has taken a leading role in changing the traditional ways of standards making. A very heavy dependence is now placed on electronic working, both outside and within meetings, advancing a trend that started in ETSI a year or two ago. This means that paper copies of draft documents have been almost entirely eliminated, saving time and expense, and making a significant contribution to the environment.

Given that 3GPP has participants from all over the world, the use of the Internet, e-mail exploders and other such facilities have proved invaluable for distributing and sharing information, working drafts and so on. Delegates to meetings had already become used to downloading working documents from the Internet and having updates to the documents distributed in meetings on CD-ROM. But in recent months, in meetings around the world, participants have experienced the benefits of a local area network (LAN) solution as the latest step in improving working methods. ETSI's headquarters premises already have LANs in all its meeting rooms, but most other venues currently rely on temporary LANs (wired or radio) using equipment and support kindly donated by individual members.

Such facilities permit delegates to access all the meeting documents electronically from their laptop computers. As a result, the huge burden of producing paper copies (as many as 40 000 pages per delegate for some meetings) can be eliminated. Delegates can access new documents as soon as they are available, rather than having to wait for paper copies to be made or for the documents to be distributed by other means, such as diskette or CD-ROM.

9.1.3.1.2 Project Support

For administrative and support purposes the 3GPP Partners have established a Mobile Competence Centre (MCC) which is hosted by ETSI at its premises in Sophia Antipolis, Southern France. The MCC was created in March 1999 to provide support not only to the 3GPP but also to ETSI's own studies in mobile technologies. A full description of MCC including the financing is given in Chapter 15, Section 3.

9.1.3.2 Who are the Stakeholders in 3GPP?

3GPP has attracted a very strong commitment from organisations and companies around the world, reflecting the truly global nature of the project. There are currently six OPs (in alphabetical order):

- The Association of Radio Industries and Businesses (ARIB), Japan

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being TD-SCDMA, proposed by CWTS. A similar group, 3GPP2, is preparing the cdma2000 specifications, UWC-136 TDMA specifications are being developed principally by UWCC, and DECT specifications are defined by a set of ETSI standards (Figure 9.1.1).

Since the UWCC and ETSI are both partners in 3GPP (as an MRP and OP respectively), there is direct liaison between the Project and these two sources of specifications for other IMT-2000 family members.

When 3GPP and 3GPP2 were created it was felt that the interests of each group were sufficiently different to require them to remain separate but here again many of the OPs and MRPs are common to both groups, so there are natural channels for information exchange. Particular instances of formal co-operation between the groups were the two joint 3GPP-3GPP2 workshops held in 1999 to address the "Hooks and Extensions" issue aimed at ensuring interworking between the respective technologies.

In addition to all this, the 3GPP TSGs and their working groups are encouraged to liase directly with relevant technical bodies within the Project as well as among the Partners.

9.1.6 Conclusions

The attentive reader, and let's assume that you are one, may still be astonished to learn what big efforts have been necessary in order to establish 3GPP.

In the meantime, i.e. in the course of year 2000 nearly the whole work of the former ETSI TC SMG has been incorporated into 3GPP, to a large extent within the new TSG GERAN.

Well, our Japanese friends were not happy about this shift because they feared that it could result in delays in the 3G introduction in their country. They accepted this because a separate TSG for the GSM work was created.

Trying to recall the heated discussions within ETSI about the scope of 3GPP from 1998, one has to admit that such a move would have been violently rejected by a lot of ETSI members, maybe even by the majority. Using a philosophic approach, one can, of course, state that time helps healing (even wounds).

Today, i.e. February 2001, we can conclude from ETSI's point of view that all standardisation work related to further evolution of the second generation mobile system, i.e. GSM, and to UMTS is being done well within 3GPP. Thus, the objective to avoid parallel work within ETSI TBs and 3GPP has been fully achieved.

The ability of organisations and individuals around the world to co-operate and make available a full set of stable, agreed 3GPP specifications in 1 year is a remarkable achievement, one that is unprecedented in the world of standardisation. 3GPP meetings have taken place in many parts of the world, emphasising the strong commitment of the SDOs from China, Europe, Japan, Korea and the US. The MRPs have also lent very strong support to the work. Thanks to this widespread and determined commitment it has been possible to meet the very aggressive targets for 3G.

But Release 99 was only the first step – the workload has continued to intensify this year, as the initial specifications are refined and many new ones added, opening the path to full, seamless, global 3G services, changing forever the way that people communicate.

In the meantime, 3GPP has changed the designation of the releases and dropped to mention the year in order to avoid irritations and wrong expectations. Release 99 was first established in December 1999 and got its maturity in the course of year 2000. In 2000, more than 5700 change requests were implemented. The next big event will be Release #4 as a result of the

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series of TSG meetings scheduled for March 2001 in Palm Springs, US. This will obviously result in a further stabilisation and extension of the UMTS specifications.

3GPP is running very well. The individual members from the six OPs seem to be very satisfied with this arrangement – and the production line is in full swing.

Without exaggeration, one can give 3GPP the attribute of a success story. One may quote again here Mr Ed Roney who even addressed the 3GPP concept – prior to its realisation – as a "paradigm shift".

As the results of the GSM and UMTS related standardisation work represent a great part of ETSI's deliverables, it might be justified to note here that during the year 2000, ETSI published more than seven new deliverables each working day (Monday through Friday), i.e. one deliverable per hour!

Further information may be found on the 3GPP website at http://www.3gpp.org.

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Chapter 9: The Third Generation Partnership Project (3GPP)

Section 2: UMTS in 3GPP (December 1998–May 2001)

Niels Peter Skov Andersen[1]

9.2.1 A Change of Environment

In the period 1982 until end of 1998 the work on the GSM standard, and in the later part of the period on UMTS, had been performed in the same environment, starting under CEPT and later transferred into ETSI. The Technical Committee GSM, during this period renamed to SMG, and its working groups (Sub Technical Committees) had continuously existed and evolved. The same was the case for the working methods and procedures used within the work. Over time with the success of the GSM system more and more interested parties became involved in the work including parties from outside the original CEPT area. However, this was all a relatively slow evolution and no major revolutions in the organisation or the working methods occurred in this period.

After all these years of continuity in the work the discussions around the creation of 3GPP and the decision to establish 3GPP for the initial phase of UMTS[2] naturally created some uncertainty amongst the members of SMG. Especially the resulting split of the GSM standardisation, with the responsibility for the GSM core network transferred to 3GPP, but the responsibility for the GSM radio access Network maintenance remained in ETSI in SMG. This caused some concern amongst many delegates. Also the internal structure for the technical work within 3GPP was different from the well-known structure in SMG. SMG was based on a technical plenary with a number of working groups (SMG1, SMG2, …, SMG12) performing the detailed technical work. The SMG plenary was the approving authority for the results of the work performed by the working groups. Also the plenary was the group responsible for approval of all new work items and the content of the releases. The structure for the work in 3GPP, as agreed by the partners, was quite different. The project

[1] The views expressed in this section are those of the author and do not necessarily reflect the views of his affiliation [illegible].

[2] The term UMTS is throughout this section used to keep consistency of terminology with the other chapters and sections. The term UMTS do not appear in the in 3GPP agreement, which defines the system as a third generation mobile system based on an evolved GSM core network and UTRAN (including UTRAN (FDD and TDD modes)).

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was organised with four equal Technical Specification Groups (TSGs), who had complete autonomy for their area of responsibility, i.e. they were responsible for approval of new work items and final approval of deliverables. The four technical groups originally defined were:

TSG CN	Responsible for the core network development
TSG-RAN	Responsible for the radio access network based on UTRAN (FDD and TDD modes)
TSG-SA	Responsible for services and system aspects
TST-T	Responsible for Terminal and UIM

In addition to the technical groups the 3GPP organisation has a Project Coordination Group (PCG). However, the role of this PCG cannot be compared to the role the SMG plenary played. The SMG plenary was an open technical group with the approving authority in all technical questions including approval of new work items. The 3GPP PCG is a closed group with a defined membership consisting of a limited number representative of each of the partners (SDOs, MRPs) and the leadership (chairman and two vice-chairmen) of each TSG. Thus as a closed group the role of the PCG becomes more like a board overlooking the overall well being of the project.

This structure made many long-term SMG delegates concerned about how the overall coordination of the project could be ensured. This new structure was not introduced to overcome known deficits of the SMG organisation, but in my opinion, by political considerations to ensure than no single individual, individual member, organisational partner could obtain a controlling position in the project.

9.2.2 The First Two TSG Meetings

The inauguration meeting of the 3GPP TSGs was held in December 1998 in Sophia Antipolis, France. In the process of creation of 3GPP this was the first time that the 3GPPs real work force – the technical experts – met. The main objectives for this first meeting was to get the work started. One of the elements of the meeting was a presentation from the different partners on the status of their work on the third generation mobile system, the work, which they now were in the process of handing over to 3GPP.

Listening to the presentations and the discussions during the breaks it was very obvious that the background for standardization amongst the delegates was quite different. As an example, I remember that during the coffee break just after I, as chairman of ETSI SMG2, had presented the status of the UMTS radio work in ETSI, and had ended my presentation by stating that the UMTS radio work would only be on the agenda of one more meeting of ETSI SMG2. This was in order to complete the documentation to be handed over to 3GPP and then the work on UMTS radio in ETSI would cease, a small group of non-ETSI delegates came to me and asked "if all work on UMTS radio in ETSI ceases, how do the Europeans then coordinate their views on 3GPP?" Coming from the ETSI SMG background this was a completely unexpected question, as the working procedures for 3GPP were very similar to those of ETSI, it was clear to me that the contributions to 3GPP in general should come from the individual members – the companies, regulators etc. – in their own name and not as regional contributions. I explained this, but I also understood that for delegates with a background in international standardization from, e.g. ITU this was the normal way of thinking. During the

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Annex 2: Organisation Evolution of the Technical Groups

Section 3: 3GPP

Adrian Scrase[1]

A2.3.1 December 1998 to Mid-1999

During the preparatory talks that led to the creation of 3GPP, many discussions took place to find the optimum organizational structure. The ETSI TC SMG model had worked well for many years and it was very tempting to adopt a similar structure and just widen the sphere of participation. However, some voices called for a more radical approach in order to streamline the structure and to reduce the time taken for specifications production. As a result of these discussions, the following key principles were established on which 3GPP was structured:

- Minimum number of hierarchical levels;
- Large degree of distributed autonomy;
- Clear separation of technical activities from political and administrative activities.

When 3GPP was created, four Technical Specification Groups (TSGs) were formed to undertake the preparation of technical specifications. The four TSGs were as follows:

- TSG CN – core network
- TSG RAN – radio access network
- TSG SA – services and system aspects
- TSG T – terminals

Each of the TSGs was authorized to develop and approve specifications and reports within its terms of reference. This represented a departure from the more traditional approach where a single entity (i.e. a plenary) within a project has the authority to approve a project's output. It was believed that by distributing the approval authority, the time taken to produce specifications would be reduced since this effectively removes one level of hierarchy from the approval procedure. However, it was apparent from the outset that distributing the approval of specifications would lead to a greater requirement for technical co-ordination and thus TSG SA was tasked to perform a co-ordination role across all TSGs. This co-ordination role

[1] The views expressed in this section are those of the author and do not necessarily reflect the views of his affiliation entity.

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APPENDIX 5



Third Generation Partnership Project

3GPP

Working Procedures

01 September 2022

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Foreword

These Working Procedures of the Third Generation Partnership Project (3GPP) are effective from 01 September 2022.

An electronic version of these Partnership Project Working Procedures is available from the following address:

http://www.3gpp.org

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SECTION A: GENERAL

Article 1: Description

The Partnership Project is not a legal entity but is a collaborative activity between the following recognized Standards Development Organizations:

ARIB (Japan)

CCSA (China)

ETSI (Europe)

ATIS (US)

TTA (Korea)

TTC (Japan)

TSDSI (India)

The Partnership Project is entitled the "THIRD GENERATION PARTNERSHIP PROJECT" and may be known by the acronym "3GPP".

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Article 2: Purpose

The purpose of 3GPP is to prepare, approve and maintain globally applicable Technical Specifications and Technical Reports for

- a 3rd Generation Mobile System based on the evolved GSM core network, and the Universal Terrestrial Radio Access (UTRA),
- further development of radio technologies such as LTE, coupled with evolution of core network elements such as the Evolved Packet Core (EPC),
- continuing evolution of the 2nd generation GSM/EDGE Radio Access Network (GERAN),

to be transposed by the Organizational Partners into appropriate deliverables (e.g., standards).

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Article 3: Scope and objectives

The 3rd Generation Mobile System and its capabilities shall be developed in a phased approach. Initially, 3GPP shall prepare, approve and maintain the necessary set of Technical Specifications and Technical Reports for a 3rd Generation Mobile System including:

- UTRAN (including UTRA; in Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes);
- 3GPP Core Network (Third Generation networking capabilities evolved from GSM. These capabilities include mobility management, global roaming, and utilisation of relevant Internet Protocols);
- Terminals for access to the above (including specifications for a UIM); and
- System and service aspects.

3GPP shall prepare, approve and maintain the necessary set of Technical Specifications and Technical Reports for:

- the Global System for Mobile communication (GSM) including GSM evolved radio access technologies (e.g., General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE)).

3GPP shall consider the long term evolution.

The Technical Specifications and Technical Reports shall be developed in view of global roaming and circulation of terminals.

The set of 3GPP Technical Specifications and Technical Reports for the 3GPP core network and the specifications for the GSM core network should be common to the greatest extent possible and should not be unnecessarily different.

Options in the form of a regulatory requirement particular to one or more regions / nations shall be included in 3GPP specifications. TSGs should not debate the inclusion or rejection of such options.

The results of the 3GPP work shall form the basis of member contributions to the ITU in accordance with existing procedures.

3GPP shall take account of emerging ITU recommendations on interworking between IMT-2000 family members.

In the framework of agreed relationships, the 3GPP Technical Specifications and Technical Reports will form the basis of standards, or parts of standards, of the Organizational Partners.

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SECTION B: PARTICIPATION

Article 4: Categories

Participation in 3GPP shall be classified into one of the following categories:

- Partners;
- Individual Members;
- ITU Representatives;
- Observers;
- Guests.

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Article 5: Partnership

Partners in 3GPP shall be classified into one of the following two categories:

- Organizational Partners;
- Market Representation Partners.

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Article 6: Organizational Partnership

Organizational Partnership is open to any Standards Organization, irrespective of its geographical location, which has:

- a national, regional or other officially recognized status and the capability and authority to define, publish and set standards within the 3GPP scope, in that nation or region;
- an Intellectual Property Rights (IPR) Policy which is compatible with those of the Organizational Partners;
- committed itself to all or part of the 3GPP scope;
- signed the Partnership Project Agreement.

Standards Organizations may apply to become an Organizational Partner by writing to any of the existing Organizational Partners.

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Article 7: Market Representation Partnership

The Organizational Partners may invite Market Representation Partners to take part in 3GPP.

An invitation for Market Representation Partnership is open to any organization, irrespective of its geographical location, which:

- has the ability to offer market advice to 3GPP and to bring into 3GPP a consensus view of market requirements (e.g., services, features and functionality) falling within the 3GPP scope;
- does not have the capability and authority to define, publish and set standards within the 3GPP scope, nationally or regionally;
- has committed itself to all or part of the 3GPP scope;
- has signed the Partnership Project Agreement.

Organizations may apply to become Market Representation Partners by writing to any of the existing Partners. Further guidance for MRP applicants can be found in annex E.

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Article 8: Individual Membership

Membership in an Organizational Partner is a pre-requisite for Individual Membership of 3GPP. All entities registered as members of an Organizational Partner and eligible for participation in the technical work of that Organizational Partner, can become Individual Members of 3GPP if they are committed to support 3GPP and:

- to contribute technically or otherwise to one or more of the Technical Specification Groups within the 3GPP scope;
- to use the 3GPP results to the extent feasible.

An Individual Member has the right to participate in the work of 3GPP by attending meetings of the Technical Specification Groups and subtending groups.

Applications for Individual Membership of a Technical Specification Group shall be made in writing to the relevant Organizational Partner using the form given at annex C. Applications may also be made on-line using the template available at http://www.3gpp.org.

Individual Members act in 3GPP in their own right and carry the full responsibility for their contributions.

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Article 9: Termination of Individual Membership

Individual Membership of 3GPP may be terminated by dissolution, abolition, resignation or expulsion from the related Organizational Partner.

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Article 10: Observers and Guests

The status of Observer may be granted by the Organizational Partners to an entity which has the qualifications to become a future Partner.

An Observer may send a single representative to an Organizational Partners or PCG meeting. An Observer may also have representatives at TSG meetings. Representatives of Observers may receive documents and contribute documents for information, but shall not submit documents that propose changes to the specifications, reports, work item descriptions, work plan, or any other document under the control of the TSG. Observers shall not take part in decision making or hold any leadership positions.

Additional participation rights of an Observer shall be decided by the Organizational Partners on a case-by-case basis.

The status of Guest may be granted for a limited period, by the Organizational Partners to an entity which has the qualifications to become a future Individual Member. The limited period shall be decided by the Organizational Partners on a case-by-case basis.

A Guest may have representatives at TSG and subtending group meetings. Representatives may receive documents but shall not take part in decision making, participate in discussions, contribute documents, or hold any leadership positions.

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SECTION C: STRUCTURE

Article 11: Structure of 3GPP

3GPP shall consist of a Project Co-ordination Group (PCG) and Technical Specification Groups (TSGs). The Technical Specification Groups may establish Working Groups if required.

The Organizational Partners may decide to call a meeting of the full 3GPP membership if required.

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SECTION D: PARTNERS' COLLECTIVE RESPONSIBILITIES

Article 12: Organizational Partners' Collective Responsibilities

The Organizational Partners shall determine the general policy and strategy of 3GPP.

In addition the Organizational Partners shall perform the following tasks:

- approval and maintenance of the 3GPP scope;

- maintenance of the Partnership Project Description;
- taking decisions on the creation or cessation of Technical Specification Groups, and approving their scope and terms of reference;
- approval of Organizational Partner funding requirements;
- allocation of human and financial resources provided by the Organizational Partners to the Project Co-ordination Group;
- acting as a body of appeal on procedural matters referred to them;
- conduct compliance training at least annually for elected leadership, relevant Support Team personnel and interested parties on best practices to follow to
  - avoid issues with respect to antitrust/competition laws and regulations;
  - fulfil the leadership/support role with impartiality and in the interests of 3GPP.

top

Article 13: Collective responsibilities of all Partners

Organizational Partners and Market Representation Partners shall perform the following tasks:

- maintenance of the Partnership Project Agreement;
- approval of applications for 3GPP partnership;
- taking decisions relating to the dissolution of 3GPP.

top

SECTION E: PROJECT CO-ORDINATION GROUP (PCG)

Article 14: PCG tasks

The PCG shall perform the following tasks:

- appointment of PCG Chair and Vice Chairs;
- allocation of human and financial resources provided by Organizational Partners to TSGs;
- allocation of voluntary human and financial resources provided by Market Representation Partners and Individual Members;
- management of the 3GPP Support Team;
- handling of appeals from Individual Members on procedural matters referred to them;
- propose and approve modifications to the Partnership Project Working Procedures;
- handling of appeals from Individual Members on technical matters referred to them;
- determination of the overall time frame and manage overall work progress;
- final adoption of new and stopped work items proposed by the TSGs within the agreed 3GPP scope and objectives;
- when a work item is outside the scope of the 3GPP, and where a common global solution is desired, recommend how to achieve a global solution;

- appointment or dismissal of TSG Chairs and Vice Chairs, as proposed by TSGs based on election results. (The proposed candidate shall be appointed unless there are extraordinary reasons that prevent such an appointment, e.g., severe company or geographical imbalance within 3GPP. In such cases the TSG shall be requested to elect an alternative candidate. The decision not to appoint a candidate shall be made by consensus.);
- authorizing requests from the TSGs for approval to liaise with external organizations, and maintain a list of approved requests;
- maintenance of the register of Individual Members eligible to participate in 3GPP;
- maintenance of the register of IPR declarations relevant to 3GPP, received by the Organizational Partners.

The PCG may decide to call a meeting of the full 3GPP membership if required.

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Article 15: PCG participation

The following shall have a right to participate in the PCG:

- Typically, a maximum of five representatives of each Organizational Partner (not counting the Chair and Vice-Chairs);
- A maximum of three representatives of each Market Representation Partner. (MRPs are however urged to limit their participation to one representative wherever possible.);
- The Chairs and Vice Chairs of the TSGs as ex-officio members;
- A maximum of three ITU representatives;
- One representative of each Observer.

top

Article 16: PCG appointment of Chair and Vice Chairs

The PCG shall appoint their Chair and Vice Chairs from amongst the Organizational Partner representatives.

The Chair and Vice Chairs shall be appointed for a one year term of office.

The Chair and Vice Chairs shall normally serve one term of office. If no other candidates are available, the Chair or Vice Chairs may be appointed for a further term.

Successive Chairs and Vice Chairs should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is available.

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Article 17: PCG Chair and Vice Chair Responsibilities

The PCG Chair is responsible for the overall management of the co-ordination work within 3GPP.

The Chair has the overall responsibility to ensure that the Partnership Project Agreement, Partnership Project Description and Partnership Project Working Procedures are followed.

The Chair may nominate officials to assist in the work.

The Chair may be assisted by the Support Team.

The Chair may delegate tasks to the Vice Chairs.

In performing their leadership role, the Chair and Vice Chairs shall maintain impartiality and act in the interests of 3GPP.

At the commencement of each meeting of the PCG, the group shall be reminded that:

(i) compliance with all applicable antitrust and competition laws is required; and

(ii) the leadership will conduct the meeting with impartiality and in the interests of 3GPP.

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Article 18: PCG meetings

A meeting of the PCG shall be held at least twice per year.

At least thirty days before the due date, a calling notice, draft agenda and supporting documents shall be issued.

top

Article 19: PCG decision making

In any meeting of the PCG, the quorum required for decision making shall be 50% of the total number of Organizational Partners. Proxies shall not be permitted.

The PCG shall endeavour to reach consensus on all issues. The views and opinions of the Market Representation Partners and the Chairs and Vice Chairs of the TSGs shall be taken into account during the consensus building process. If consensus cannot be achieved, the PCG Chair can decide to take a vote. The vote may exceptionally be performed by a secret ballot if decided by the PCG.

Each Organizational Partner shall have one vote. A proposal shall be deemed to be approved if 71% of the votes cast are in favour. Abstentions or failure to submit a vote shall not be included in determining the number of votes cast.

top

SECTION F: TECHNICAL SPECIFICATION GROUPS

Article 20: TSG tasks

The TSGs shall prepare, approve and maintain the 3GPP Technical Specifications and Technical Reports taking into account the market requirements provided by Market Representation Partners.

The TSGs shall also perform the following tasks:

- Propose to the PCG for appointment TSG Chair and Vice Chairs based on election results;
- Creation of TSG Working Groups and approval of their terms of reference;
- When a new Working Group is created, the appointment of TSG Working Group Convenor;
- Allocation of resources within the TSG;
- Allocation of voluntary human and financial resources provided by Market Representation Partners and Individual Members;
- Handling of appeals from Individual Members on technical matters;
- Preparation of a detailed time frame and management of detailed work progress;

- Management of work items;
- Technical Co-ordination;
- Proposal and approval of work items within the agreed scope and terms of reference of the TSG;
- Where a work item is outside the scope of the 3GPP, but a common global solution is desired, recommend an approach to the PCG;
- Assignment of work to Partners. (Specification development may be accomplished using various methods, including the assignment of work to Partners.);
- Maintenance of the list of Individual Members eligible to vote within the TSG (Voting Members).

top

Article 21: TSG participation

The following shall have a right to participate in the TSGs:

- Representatives of members of participating Organizational Partners (i.e. Individual Members);
- Representatives of Organizational Partners;
- Representatives of Market Representation Partners;
- Representatives of Observers;
- Representatives of Guests.

top

Article 22: TSG and WG election of Chair and Vice Chairs

22.1 TSG elections

Regular TSG elections shall be held every two years in the first semester of odd numbered years.

The TSG Chair and Vice Chairs shall be elected by the Technical Specification Group from amongst the Individual Member representatives. Each TSG shall elect a maximum of three Vice Chairs.

A candidate for election to a TSG Chair or Vice Chair position shall provide a letter of support from the Individual Member that they represent. The support letter from the Individual Member shall indicate that the candidate will avail or has availed themselves of 3GPP supplied antitrust and competition law training in order to comply with all applicable antitrust/competition laws and regulations while acting in the capacity of TSG Chair or Vice Chair.

Nominations may be made up to the point when an election takes place.

The Chair and the Vice Chairs shall be elected for a two year term of office. The Chair and Vice Chairs may offer themselves for election for a second consecutive term. The term “consecutive” is taken to mean terms one after the other without another person being elected to the position in the interim. Exceptionally, they may offer themselves for further consecutive terms, subject to the following:

- A two week deadline that expires at noon Central European Time on the Friday which falls between 20 and 14 days prior to the first day of the meeting at which elections are due to be held shall be established.
- A Chair is not permitted to stand for another consecutive term if another candidate is announced via the 3GPP web site or via the relevant 3GPP email reflector prior to this deadline.
- A Chair is not permitted to stand for another consecutive term until after this deadline.

- A Vice Chair is not permitted to stand for another consecutive term in a Vice Chair position for which there is a candidate announced via the 3GPP web site or via the relevant 3GPP email reflector prior to this deadline.

- A Vice Chair is not permitted to stand for another consecutive term until after this deadline. If, by the deadline, the number of candidatures is less than the number of Vice Chair positions, then any incumbent Vice Chair may put forward their candidature.

There is no restriction on a Vice Chair whose term of office is due to expire offering himself for the position of Chair; neither is there any restriction on a Chair whose term of office is due to expire offering himself as a Vice Chair. There is no restriction of a retiring Chair or Vice Chair of one TSG offering himself for election as either Chair or Vice Chair of any other TSG (or WG).

Should the office of Chair or Vice Chair of a TSG become vacant for reasons other than expiration of term of office, a special election shall be conducted to fill the unexpired term. This special election shall be conducted at a meeting of the TSG, and shall be announced in the agenda according to the provisions of article 32.

When such a special election is held to fill the office of Chair, and one or more of the Vice Chairs of the TSG intends to stand for election to that position, the announcement shall also indicate that there will be an election to fill the position of Vice Chair in the event that a Vice Chair be elected to the office of Chair. If at the special election the Vice Chair is elected to the office of Chair, that individual shall become Chair immediately, and, the position of Vice Chair thus being vacant, an election shall be held for the office of Vice Chair.

Similarly, if an incumbent Chair intends to stand for election to the position of Vice Chair, the same applies, with the necessary changes to the text above.

If a Chair or Vice Chair changes the Individual Member that they represent (e.g., job change, merger or acquisition) during their term of office, a new letter of support shall be provided. In order to provide a new letter of support, a Chair or Vice Chair may request a grace period allowing their term to be extended the lesser of 6 weeks or until the day before the next scheduled regular term (e.g., every 2 years) election. Although the term is extended, under the rules of article 22, the Chair or Vice Chair can only chair meetings when representing an Individual Member. This rule continues to apply during the grace period. If the change of company affiliation is due to a move to another company, then the decision for the Chair or Vice Chair to continue in office to the end of the present term shall be made by consensus of the TSG. If consensus cannot be achieved, a special election shall be held for the office. The incumbent Chair or Vice Chair is permitted to offer their candidacy in a special election even if they have held the position for 2 terms or more.

The term of office for a Chair or Vice Chair elected at a special election is a partial term lasting until the end of the current term. If a new Chair or Vice Chair is elected at a special election then the partial term of office does not count towards the two consecutive term limit. If the previous Chair or Vice Chair is re-elected at a special election then the entire term (of two parts) is considered as a single term and does count towards the two consecutive term limit.

Chairs and Vice Chairs should not be from the same region, Organizational Partner, or from the same group of companies, unless no other candidate is available.

Successive Chairs should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is available. This does not apply to special elections or to regular elections for a second or subsequent consecutive term of office .

When a new TSG is established, the Organizational Partners shall appoint a convenor for the first two TSG meetings. The election for TSG Chair and Vice Chairs shall take place at the second TSG meeting. If the election takes place other than at the normal time for TSG elections (see above), the elected Chair and Vice Chairs shall serve until the next regular TSG election. This partial term of office does not count towards the two consecutive term limit. The provisions of this paragraph may be overridden by consensus of the PCG where a new TSG is formed by the merger of existing TSGs; under these circumstances, the PCG shall establish a set of ad hoc rules for the creation of the new TSG.

Following election by the TSG, the TSG Chair and Vice Chairs shall be appointed by the PCG on the proposal of the TSG.

top

22.2 WG elections

The provisions concerning the election of WG Chairs and Vice Chairs shall be as for TSG Chairs and Vice Chairs as defined in 22.1 above, changing TSG to WG wherever TSG is mentioned, with the following differences.

Each WG shall elect a maximum of two Vice Chairs.

WG elections shall be held when the corresponding terms of office expire or when an existing Chair or Vice Chair resigns. WG elections need not be synchronized within the WG (i.e. elections for Chair and each Vice Chair may occur at different times), across different WGs of the same or other TSGs, nor with the regular TSG elections.

WG Chairs and Vice Chairs are always elected for a period of two years (and not, as is the case with special elections in TSGs, for the unexpired period of the present term of office). An exception to this is where the previous Chair or Vice Chair is re-elected in the special election. In this case the Chair or Vice Chair continues for the unexpired period of the present term of office.

Note: For this reason, elections for WG Chairs and Vice Chairs are likely to become spread over a period of time, rather than being grouped like the TSGs' regular elections.

When a new WG is established, the parent TSG is responsible for appointing a convenor for the first two meetings.

Following election by the WG, the Chair and Vice Chairs hold office immediately, without need of appointment by TSG or PCG.

If a WG does not meet physically with enough frequency to maintain an up to date voting list, the working group may elect to escalate the voting for officers to the parent TSG.

top

Article 23: TSG and WG Chair and Vice Chair responsibilities

The TSG Chair is responsible for the overall management of the technical work within the TSG and its Working Groups. The Chair has an overall responsibility to ensure that the activities of the TSG follow the Partnership Project Working Procedures.

The WG Chair is responsible for the overall management of the technical work within the WG and its sub-groups.

The Chair may nominate officials to assist in the work.

The Chair may delegate tasks to the Vice Chairs.

The Chair may be assisted by the Support Team.

The Chair shall form a Management Team, including the Vice Chairs and Support Team, in order to assist in discharging the Chair’s duties.

Recognizing the need to balance the requirement of rapid specification development with the limited resources of delegates, the Chair should encourage a minimum number of meetings, especially parallel meetings, and maximize the use of electronic means to advance the work.

In performing their leadership role, the Chair and Vice Chairs shall maintain impartiality and act in the interests of 3GPP.

At the commencement of each meeting of a TSG or WG, the group shall be reminded that:

(i) compliance with all applicable antitrust and competition laws is required;

(ii) timely submissions of work items in advance of TSG or WG meetings are important to allow for full and fair consideration of such matters; and

(iii) the leadership will conduct the meeting with impartiality and in the interests of 3GPP.

top

Article 24: TSG and WG Chair and Vice Chair dismissal

A secret ballot shall be taken for the proposal to dismiss a TSG or WG Chair or Vice Chair because of a failure to effectively perform their duties, if requested by 30% of the TSG or WG membership list. 71% of the votes cast are required to recommend dismissal.

The PCG shall dismiss a Chair or Vice Chair on the proposal of the TSG.

top

Article 25: TSG and WG decision making

TSGs and WGs shall endeavour to reach consensus on all issues, including decisions on Technical Specifications and Technical Reports. Informal methods of reaching consensus are encouraged (e.g., a show of hands). If consensus cannot be achieved, the Chair can decide to take a vote. The vote may exceptionally be performed by a secret ballot if decided by the TSG or WG. A vote may be conducted during a TSG or WG meeting or by correspondence.

A proposal shall be deemed to be approved if 71% of the votes cast are in favour. Abstentions or failure to submit a vote shall not be included in determining the number of votes cast.

It is the responsibility of the Chair to ensure that questions to be voted upon are phrased in a positive yes/no manner, with 71% required to approve the question. Questions should not be phrased as the TSG shall not do something. Examples of appropriate questions are; Shall the TSG approve the Specification and send it to the SDOs? Shall the liaison be approved? Shall the new WI be approved? Shall the existing WI be stopped? If the issue is to choose option A or B, the question should be split into two questions, with the Chair selecting the order. First, shall the TSG take option A as the way forward? If this question fails the second question is, shall the TSG take option B as the way forward?

Contributions on which decisions will be based should be made available in good time before each meeting. TSGs may establish informal guidelines for dealing with late contributions.

If a WG does not meet physically with enough frequency to maintain an up to date voting list, the working group may elect to escalate the voting to the parent TSG.

Working Agreements may be used to establish tentative agreements in cases where consensus cannot be obtained. The working agreement process is described in annex G.

top

Article 26: TSG and WG voting during a meeting

The following procedures apply for voting during a TSG or WG meeting:

- before voting, a clear definition of the issues shall be provided by the Chair;
- Voting Members shall only be entitled to one vote;
- if a Voting Member has more than one representative present, only one representative may vote;
- each Voting Member may only cast the vote once;
- each Voting Member may carry proxy votes for up to five other Voting Members. All proxy votes shall be accompanied by a letter of authority from the authorising Voting Member. Proxies will not be taken into account when determining the quorum;
- the quorum required for voting during a TSG or WG meeting shall be 30% of the total number of Voting Member companies on the TSG or WG voting list;
- the result of the vote shall be recorded in the meeting report.

For the determination of the quorum, see annex H.

top

Article 27: TSG or WG voting by correspondence

The following procedures apply for voting by correspondence:

- before voting, a clear definition of the issues shall be provided by the Chair and disseminated to all on the TSG or WG membership list;
- Voting Members shall only be entitled to one vote;
- each Voting Member may only cast the vote once within the voting period;
- the voting period shall be 30 days;
- there are no quorum requirements;
- The result of the vote should be disseminated to the TSG or WG.

- top

Article 28: TSG or WG voting for the election of TSG or WG Chair and Vice Chair

In the case where there is more than one candidate for TSG or WG Chair or Vice Chair, a secret ballot shall be used. For interpreting the result of the secret ballot the following procedure shall apply:

When, in the first ballot, no candidate has obtained 71% of the votes cast, a second ballot shall be held. In the second ballot, in cases where there are only two candidates, the candidate obtaining the higher number of votes is elected. In cases where there are more than two candidates, if none of them has obtained 71% of the votes, a third and final ballot shall be held among the two candidates who have obtained the highest number of votes in the second ballot. The candidate obtaining the higher number of votes in the third ballot is then elected.

The TSG or WG Chair shall be responsible for the voting process and shall ensure that confidentiality is maintained.

top

Article 29: TSG or WG appeal process

An Individual Member of 3GPP who opposes a Chair's ruling on a vote taken within a TSG or WG may submit their case to the PCG for decision. In such cases the Individual Member shall also inform the relevant TSG or WG Chair.

When a TSG or WG Chair has made a ruling, their decision shall be taken as the basis for future operations, unless or until overturned by the PCG.

If an Individual Member in a TSG or WG believes that a Chair or Vice Chair of any such group is acting without impartiality and not in the interests of 3GPP, such Individual Member may object to such actions within the relevant group, and may request that such objection be recorded in the minutes of the applicable group meeting and it shall be so recorded. The objecting Individual Member may ultimately take their objection to the PCG for consideration. In such cases the Individual Member shall also inform the relevant TSG or WG Chair.

top

Article 30: TSG and WG meetings

TSGs and WGs shall meet as necessary to complete their work within the prescribed timeframe. TSGs should endeavour to hold their meetings at the same time and place to assist in the overall co-ordination of the work.

Meeting locations should reflect the geographical diversity of the TSG and WG delegates.

Further information on meetings is given in annex F.

top

Article 30A: TSG and WG participation

IMs wishing to progress work on topics in 3GPP are expected to participate physically in the meetings.

If a 3GPP IM is materially interested in a specific topic but is unable to participate in a meeting by sending a delegate, the IM is urged to engage the support of other IMs whose delegates will be present at the meeting to present its views. If this is not possible for any reason, the IM may advise the Chair of the situation and may provide documents supporting their position. The Chair may facilitate the introduction of these documents during the meeting and the record of the meeting can include the discussion and outcome. Note that physical participation in meetings is considered the norm and the option to engage the Chair is intended for exceptional situations. The Chair has the right to decline the request.

top

Article 31: TSG and WG meeting invitation

The invitation to a TSG or WG meeting and the necessary logistical information should be disseminated as soon as practically possible, taking into account the need to obtain travel documentation. It shall be disseminated at least 28 days before the meeting to all on the TSG or WG membership list.

top

Article 32: TSG and WG meeting agenda

The draft agenda for a TSG or WG meeting shall be disseminated by the responsible Chair to all on the TSG or WG membership list at least 21 days before a meeting. The draft agenda should indicate subject matters where voting may be required. The draft agenda shall indicate elections to be held (including known candidates). The draft agenda shall indicate the deadlines (dates and times) for registration and meeting document submission to the TSG/WG meeting. Other deadlines may also be indicated (whenever required).

top

Article 33: TSG and WG meeting registration

Delegates and officials must register before participating in any 3GPP meeting. Each delegate or official who represents an Individual Member shall declare the precise name of that Individual Member. A delegate or official may only register to represent one Individual Member.

The deadline for registration for all delegates and officials is one week in advance of the start of the meeting. Registrations after this deadline will still be processed, but timely receipt of meeting related information is not guaranteed for late registrants.

To aid in communication, delegates or officials at co-located meetings may briefly visit a meeting they have not registered for. However, any extensive involvement such as presenting a contribution or formally objecting requires prior registration to the meeting.

top

Article 34: TSG and WG meeting document and file naming

Documents for a TSG or WG meeting shall follow a consistent numbering system as shown in the following example:

xminnzzzz

This numbering system has six logical elements:

1) **x**: a single letter corresponding to the TSG;

   where x : **R** (Radio Access Network)

   N (Core Network) [TSG closed March 2005]

   S (Service and System Aspects)

   T (Terminals) [TSG closed March 2005]

   G (GSM/EDGE Radio Access Network)

   C (Core network and Terminals)

2) **m** A single character corresponding to the Working Group identity (typically 1, 2, 3, etc) or, in the case of the TSG itself, the letter "**P**".

3) **i**: Normally the hyphen character "-". May take on other values depending on the nature of the meeting at which the document is presented, eg the identity of a subgroup.

4) **nn**: two digits to indicate the year, i.e. 99, 00, 01, etc;

5) **zzzz**: unique number of the document

No provision is made for the use of revision numbers. Documents which are a revision of a previous version should indicate the document number of that previous version.

The filename of documents shall be the document number. Documents may be compressed to .Zip files (and thus bear a file extension ".zip"). For example, document **S1-060357** will be contained in file **S1-060357.zip**.

top

Article 35: TSG and WG Voting Membership List

35.1 Voting list

Each TSG and WG shall maintain a list of Individual Members eligible to vote in that group.

The voting list shall be used to establish quorum and for determining those eligible to take part in a vote.

NOTE 1: The term "membership list" has no particular significance in the context of TSG and WG meetings. The term "attendance list" is used for a list of individuals who attend a given meeting representing an Individual Member or other entity entitled to participate in meetings – see annex F.

For the determination of the quorum, see annex H.

top

35.2 On creation of new TSG or WG

When a new TSG or WG is formed an Individual Member is added to the voting list at the first meeting at which it is represented, and may vote at the second meeting where it is represented.

Exceptionally, if inadequate notice (less than the period of time given in article 31) had been given for the first meeting of the new group, an Individual Member shall be added to the voting list on its delegate's attending the second meeting (the election meeting) and vote at that meeting even if it had not been represented at the group's first meeting.

Only an Individual Member that had been represented at the group's first meeting may provide a proxy for the second meeting.

top

35.3 Established TSGs and WGs

To qualify for the voting list it is necessary for at least one delegate of an Individual Member to attend at least two meetings of the group concerned, without being removed according to the provisions of article 35.4..

An Individual Member having been represented at at least two ordinary meetings of the group has the right to cast a vote by proxy (see article 26). Thus an Individual Member may not cast a vote by proxy during a meeting at which it is not represented unless it had already been represented at two or more qualifying meetings of the group.

top

35.4 Removal from and reinstatement to voting list

An Individual Member which is not represented at three consecutive meetings of the TSG or WG shall be removed from the voting list.

The right to vote is reinstated at the second meeting which a delegate of the Individual Member attends without missing the number of consecutive meetings mentioned in the previous paragraph (but see article 35.3 for eligibility to cast a proxy vote).

EXAMPLE 1: If Individual Member Z is represented at meeting K and K+3 (and is thus eligible to vote) but is not represented at meetings K+4, K+5 and K+6, it is removed from the voting list.

EXAMPLE 2: If Individual Member X, not previously having been represented at a meeting of the group, is represented at meetings N and N+3, it may cast a vote at meeting N+3.

NOTE: Individual Member X might choose to cast a vote by proxy at meeting N+3, even though its delegate is physically present. This is sometimes useful for coordinating company positions where one large company has several Individual Memberships, possibly via several different Organizational Partners.

EXAMPLE 3: If Individual Member Y, not previously having been represented at a meeting of the group, is represented at meeting N only, it may not cast a vote by proxy at meeting N+2.

top

35.5 Meetings other than ordinary meetings

Any group that wants to call an electronic meeting (audio, video, document distribution by posting or e-mail, etc) may do so, although this works best with smaller groups. Therefore, all electronic meetings are allowed but only ordinary meetings (see annex F) count towards attendance. However, if a meeting is designated as face-to-face, provision of bridge and speakerphone capabilities for those requesting it would be at the discretion of the host. Those participating by speakerphone are not to be counted toward quorum or attendance, and are not allowed to vote.

For the determination of the quorum, see annex H.

top

Article 36: TSG Sub Working Groups

A Working Group may establish a Sub Working Group (SWG) with defined Terms of Reference. The Working Group shall appoint a SWG Chair. The SWG shall work by consensus. The meeting notice requirements for a SWG meeting are the same as for TSGs and WGs.

top

SECTION G: WORK PROGRAMME AND TECHNICAL CO-ORDINATION

Article 37: Work Programme

The 3GPP Work Programme shall consist of Work Items defined by the TSGs.

top

Article 38: Work Items

A 3GPP Work Item is a specification task defined in terms of the following principal parameters:

- title;
- intended output (i.e. Technical Specifications or Technical Reports);
- impact on other Technical Specifications and Technical Reports;
- technical scope, including the field of application of the intended output;
- impact on other 3GPP Work Items;
- the schedule of tasks to be performed;
- the identities of the supporting Individual Members;
- the identity of the Work Item Rapporteurs.

- top

Article 39: Work Item creation

Each proposed new Work Item shall be supported by at least four Individual Members, and their names shall be recorded in the Work Item definition prepared for the TSG approval. One or more persons shall be named as Rapporteur for the proposed Work Item, and the Rapporteur shall act as the prime contact point on technical matters and for information on progress throughout the drafting phases. The supporting Individual Members are expected to contribute to and progress the new work item throughout the drafting phases.

In addition to the above, TSGs shall approve new Work Items, giving all essential parameters. The proposal shall be entered into the 3GPP work programme, clearly marked as a new entry, for which a unique reference identity shall be allocated.

top

Article 40: Work Item adoption by PCG

The 3GPP work programme shall be made available to all Individual Members. A new Work Item shall remain flagged as "new" until the end of the month following the month during which the 3GPP work item was entered into the 3GPP work programme. A new Work Item shall be adopted by the PCG unless a substantial objection is received from an Individual Member or Partner during this period. At the end of the period, the "new" flag shall be removed (even if there is an objection) and it is the responsibility of any objecting Individual Member or Partner to discuss their objections with the TSG Chair. If it is not possible to resolve the objection, it is the responsibility of the Individual Member or Partner to raise the issue with the PCG.

The TSGs shall ensure that the 3GPP Work Item details are maintained at regular intervals.

top

Article 41: Work Item stopping

Prior to completion of the intended 3GPP output, the responsible TSG may conclude that a Work Item is no longer required. Any Work Item shall automatically be considered by a TSG for stopping, if no progress has been achieved in a given period of time, typically six months, e.g. due to a lack of contribution. In such cases, the Work Item shall be flagged as "stopped" in the Work Programme. The proposal to stop a Work Item shall be fully justified.

The Work Programme shall be updated accordingly, and shall show the Work Item as "stopped" until the end of the month following the month during which the Work Item was initially flagged.

The Work Item will be stopped by the PCG unless substantial objection is received from an Individual Member during this period. It is the responsibility of any objecting Individual Member to discuss their objections with the TSG Chair. If it is not possible to resolve the objection, it is the responsibility of the Individual Member to raise the issue with the PCG.

top

Article 42: Technical co-ordination

The PCG shall be responsible for determining the overall time frame and for managing the overall work progress. The System Aspects TSG shall have a particular responsibility for the technical co-ordination of work being undertaken within 3GPP, and for overall system architecture and system integrity. Problems encountered in performing this technical co-ordination role shall be reported immediately to the PCG.

top

SECTION H: DELIVERABLES

Article 43: Deliverable types

3GPP shall prepare, approve and maintain documents known as Technical Specifications and Technical Reports. Such documents shall be drawn up by the TSGs and shall, following approval at that level, be submitted to the participating Organizational Partners to be submitted to their respective standardization processes.

top

Article 44: Approval process

Approval of Technical Specifications and Technical reports by a TSG shall normally be by consensus.

Where consensus cannot be achieved in the TSG a vote may be taken.

When Technical Specifications and Technical Reports become sufficiently stable, they shall be put under change control of the relevant TSG. The further elaboration of these Technical Specifications and Technical Reports shall be achieved by change requests to be approved by the TSG.

top

Article 45: Drafting rules

The Technical Specifications and Technical Reports drafted by the TSGs shall follow the 3GPP drafting rules, using document processing facilities, format, languages and notations agreed by the Organizational Partners, and on a medium suited for electronic document handling and publishing.

top

Article 46: Copyright and ownership

The Organizational Partners will have joint ownership (including copyright) of the Technical Specifications and Technical Reports produced by 3GPP.

top

Article 47: Conversion by Organizational Partners

Organizational Partners shall use their best endeavours to convert the Technical Specifications and Technical Reports approved by the Partnership Project into national/regional deliverables in a timely manner through their normal processes.

The Organizational Partners are urged not to change the technical parts of the Technical Specifications and Technical Reports; they may add non-technical parts required by their own deliverable schemes and they may add descriptions of options selected.

Organizational Partners should ensure that all unresolved comments raised during their public enquiry and approval phases are delivered to the appropriate TSG.

top

SECTION I: REPORTING

Article 48: Chair’s reporting obligations

A report shall be prepared by the Chair following all PCG and TSG meetings.

top

Article 49: Changes to structure and officials

The Chair of each TSG shall inform the PCG of all organizational changes concerning Working Groups and their officials. An up to date record of the 3GPP structure shall be maintained.

top

Article 50: Calendar of meetings

The PCG and TSGs shall maintain an up to date calendar of the dates and venues for future meetings.

top

SECTION J: EXTERNAL RELATIONS

Article 51: Relationship with the ITU

3GPP results should be submitted to the ITU as appropriate.

For working groups, the following handling of communications toward ITU shall apply:

1 Working groups shall send ITU submissions which are destined to become part of ITU deliverables to their parent TSG for review.

2 Working group communications towards the ITU which are NOT destined to become part of an ITU deliverable must be reviewed by the TSG Chair and the appropriate ITU sector convener (if one exists for the given ITU sector). The working group's TSG Chair and ITU sector convener will determine if such a communication should be sent to the parent TSG for review. If for some reason either the TSG Chair or ITU sector convener is not available, then it is sufficient for the remaining person to review the document and determine if it should be escalated to the TSG or not.

3 If the working group communication does not require TSG review, then it shall be conveyed to the ITU from the WG using one of the mechanisms described below.

For TSGs, the following handling of communications toward ITU shall apply:

1 TSGs shall send ITU submissions which are destined to become part of ITU deliverables to the PCG for review.

2 TSGs communications towards the ITU which are deemed sensitive by the TSG shall be sent to the PCG for review.

3 If the TSG does not judge the communication as sensitive, then it shall be conveyed to the ITU from the WG using one of the mechanisms described below.

To convey a communications towards the ITU, one of the following mechanisms shall be used based upon determination of the sending body (a body may determine a default mechanism).

a) The communication shall be sent from the OPs as a deliverable from their organizations (applicable to PCG reviewed communications only)

b) The communication shall be made by Individual Members who are also members of the ITU. In such a circumstance, the appropriate ITU sector convener will coordinate and handle the administrative matters for the submission. 3GPP Technical Specifications and Technical Reports may be taken as the technical content of such contributions (applicable to PCG reviewed communications or TSG reviewed communications).

c) The communication shall be sent directly from the 3GPP liaison coordinator to the appropriate ITU receiver in the ITU (applicable to TSG reviewed communications or WG reviewed communications).

Representatives of ITU-D, ITU-R and ITU-T are invited to participate in the Project Coordination Group for the efficient coordination and exchange of information.

top

Article 52: Relations with other groups

TSGs and WGs are encouraged to liaise directly with the relevant technical bodies within the 3GPP and Partners as appropriate.

A liaison statement shall clearly communicate what is expected from the receiver, i.e., which parts are for information, which questions are expected to be clarified and by whom (especially if there are multiple receivers), and also when an answer is needed, e.g., when is the next meeting of the group sending the liaison statement.

A TSG or any subtending Working Group may send individual liaisons to any external organization (other than ITU) without PCG approval, except if the statement is considered sensitive by the TSG Chair, in which case PCG clearance is needed.

It is not necessary to have all external liaisons copied to the PCG and/or TSG SA. The liaison originating TSG should decide, at its own discretion, which should be copied. External liaisons that may have management implications such as schedules, organization, process, procedures, and policy shall be copied to the PCG, or approved by the PCG if sensitive.

Relations with the ITU are described in article 51.

top

SECTION K: MISCELLANEOUS

Article 53: Resources

The resources for the operation of 3GPP shall be managed by the Organizational Partners. The resources are allocated to the TSGs by the PCG.

top

Article 54: Support Team

The Partners shall provide logistical support to, and assist in the operation of, 3GPP. The support shall be in the form of a Support Team which shall operate under the overall management of the PCG and the day to day management of TSGs.

top

Article 55: Intellectual Property Rights (IPR) Policy

Individual Members shall be bound by the IPR Policy of their respective Organizational Partner.

Individual Members should declare at the earliest opportunity, any IPRs which they believe to be essential, or potentially essential, to any work ongoing within 3GPP. Declarations should be made by Individual Members to their respective Organizational Partners.

Organizational Partners should encourage their respective members to grant licences on fair, reasonable terms and conditions and on a non-discriminatory basis.

top

Article 56: Working language

The working language for 3GPP shall be English.

Meetings of the PCG and TSGs shall be conducted in English.

3GPP Technical Specifications and Technical Reports shall be prepared in English (as defined by the Shorter Oxford English Dictionary).

top

Article 57: Duration

3GPP shall be task oriented and on completion of the tasks the future of 3GPP shall be re-considered. The continuation of 3GPP shall therefore be confirmed by the Organizational Partners on an annual basis.

top

Article 58: Review of activities

An evaluation of the activities of 3GPP should be made by the Organizational Partners at regular intervals.

top

Article 59: Dissolution, winding up

In the event of a voluntary dissolution of 3GPP, the Partners shall determine the terms of liquidation by consensus. All issues shall be documented and distributed at least 30 days prior to decisions being made.

top

Article 59A: Exhaustion of appeal procedures

In connection with any claim or dispute of an Individual Member arising from or relating to any activity of any 3GPP meeting or action, including in connection with a TSG or WG meeting, such Individual Member shall, prior to commencing any such legal proceeding against 3GPP, its leadership, support staff, or one or more Organizational Partners in a court, an arbitral panel or other adjudicatory body, exhaust all appeal procedures provided in the 3GPP Working Procedures. Exhaustion of appeal procedures shall be diligently expedited by both the appealing party and the appeal body.

top

Article 60: Amendments to 3GPP Working Procedures

These Partnership Project Working Procedures may only be amended by decision taken by the PCG.

top

Annex A: Definitions

Consensus:	General agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interest and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments. (Note: consensus need not imply unanimity).
Conversion:	The transformation of a 3GPP output document into an Organizational Partners deliverable following the Organizational Partners' recognized processes.
Delegate:	An individual taking part in a TSG/WG meeting physically or by electronic means.
Drafting Rules:	A document approved by the Organizational Partners providing rules for the drafting of 3GPP Technical Specifications and Technical Reports.
Election:	The voting process used to identify an individual from a number of individuals.
Guest:	An entity fulfilling the criteria to become a future Individual Member, which has been granted temporary participation rights in the 3GPP
Individual Member:	A member of an Organizational Partner having participation rights within that Organizational Partner and which has registered to take part in 3GPP.
ITU Representative	Representatives of ITU-D, ITU-R and ITU-T invited to participate in the Project Coordination Group for the efficient coordination and exchange of information.
Leadership:	A Chair, Vice-Chair, or Convenor of an OP/PCG/TSG/WG/SWG/Ad-Hoc or any other 3GPP meeting.
Market Representation Partner:	A Partner invited by the Organizational Partners to participate in 3GPP to offer advice and to bring into 3GPP a consensus view of market requirements.
Observer:	An Organization fulfilling the criteria to become a future Partner which has been granted temporary participation rights in 3GPP.
Organizational Partner:	A recognized Standards Organization which has been accepted as a Partner in 3GPP.
Partner:	An Organizational Partner or a Market Representation Partner of 3GPP.
Partnership Project Agreement:	The document signed by 3GPP Partners defining their rights and obligations.
Partnership Project Description:	A document which describes the overall structure and operation of 3GPP.
Represent:	Attend on behalf of. A person who attends a meeting on behalf of an Individual Member represents that Individual Member. The person is not necessarily employed by that Individual Member, but may be, for example, employed by a subsidiary company in the same group as the represented Individual Member; or the person may be an independent consultant under contract to the Individual Member. "Representation" sometimes influences the eligibility to vote – see article 35 and annexes A and F.
Sub Working Group	A subordinate body of a Working Group.
Support Team:	A number of persons dedicated to support 3GPP.
Technical Report:	A 3GPP output document containing mainly informative elements approved by a Technical Specification Group.
Technical Specification:	A 3GPP output document containing normative provisions approved by a Technical Specification Group.
Voting Member	An Individual Member who has voting rights within a TSG/WG.
Work Item:	The documented record of a specific technical activity of 3GPP.
Work Programme:	The documented record of the all technical activities of 3GPP.
Working Group:	A subordinate body of a Technical Specification Group.

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Annex B: Abbreviations

3GPP	Third Generation Partnership Project
ARIB	Association of Radio Industries and Businesses
ATIS	Alliance for Telecommunications Industry Solutions (successor to T1)
CCSA	China Communications and Standards Association (successor to CWTS)
CDMA	Code Division Multiple Access
CWTS	China Wireless Telecommunications Standards Group (superseded by CCSA)
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
GSM	Global System for Mobile Communication
IM	Individual Member
IMT-2000	International Mobile Telecommunication
ITU	International Telecommunication Union
MRP	Market Representation Partner
PCG	Project Co-ordination Group
SWG	Sub Working Group
T1	Standards Committee T1 (superseded by ATIS)
TDD	Time Division Duplex
TSDSI	Telecommunications Standards Development Society, India
TSG	Technical Specification Group
TTA	Telecommunications Technology Association
TTC	Telecommunication Technology Committee
UIM	User Identity Module
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network
WG	Working Group

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Annex C: Individual member application form

APPLICATION FORM
for INDIVIDUAL MEMBERSHIP
of the THIRD GENERATION PARTNERSHIP PROJECT
Please complete this form and return it to your Organizational Partner

COMPANY NAME .....

Please indicate below which ORGANIZATIONAL PARTNER you are a member of

ARIB	
CCSA	
ETSI	
ATIS	
TSDSI	
TTA	
TTC	

Please indicate below which Technical Specification Groups you wish to participate in:

Radio Access Network	
Core Network and Terminals	
Service and System Aspects	
GSM EDGE Radio Access Network (GERAN)	

Upon your approval as an Individual Member of the Third Generation Partnership Project you agree that you will be bound by the Working Procedures of the Third Generation Partnership Project then in effect and as they may be amended from time to time.

Signed by (Authorized Representative) (See Note 1)	
Print name	
Position	
Date	
Telephone	
Fax	
Email	
Company Website URL	

Contact person's family name (See Note 2)	
Contact person's given name	
Job title	
Mailing address	
Telephone	
Fax	

Email	

Note 1: Is either the official contact person or voting contact of a company.

Note 2: People attending meetings and who can also have signing authority.

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Annex D: (Void)

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Annex E: Guidance for MRP applicants

E.1 Introduction

The conditions for the acceptance of Market Representation Partners (MRPs) in 3GPP are given in article 7 of these Working Procedures. This annex provides additional guidance to MRP Applicants.

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E.2 Guidance

During the application process, the Organizational Partners will need to be assured that an Applicant:

(a) Has a field of interest directly or indirectly related to the work being undertaken by 3GPP;

(b) Has attained a demonstrable level of recognition within this field of interest;

(c) Has an understanding of the market requirements relevant to 3GPP;

(d) Is willing to actively contribute to the work of 3GPP and has sufficient resources for this purpose;

(e) Fully supports the goals and objectives of 3GPP and does not take part in activities that conflict with these goals and objectives.

In processing an application, the Organizational Partners will peruse openly available documentation published by an Applicant, including material posted on its Website, in order to confirm that the points listed above have been satisfied.

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Annex F: Guidance on meeting organization

F.1 Meeting classification

TSG and WG Meetings are classified either:

- ordinary; or
- ad hoc.

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F.2 Ordinary meetings

Ordinary meetings are ones where the regular business of the TSG or WG is conducted. Such meetings are normally chaired by the Group's Chair or, if unavailable, a Vice Chair. Ordinary meeting should be announced at least six months prior to the opening day of the meeting.

TSG and WG ordinary meetings shall follow an incrementing number sequence. If an additional ordinary meeting is required between two ordinary meetings, the sequence may be preserved, even though this means renumbering subsequent meetings, or the additional meeting may be numbered using the 'bis' suffix as a numbering scheme.

Attendance at an ordinary meeting counts towards an Individual Member's eligibility to cast a vote in the Group (see articles 26 and 27). The Support Team shall record the participation in an ordinary meeting (each person and organization represented) and the attendance list shall be included in the meeting report.

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F.3 Ad hoc meetings

An ad hoc meeting of a WG or a TSG is one called to address one or more particular topics. The ad hoc meeting shall be called by decision of the WG (or its parent TSG) or TSG concerned; the decision to hold any subsequent ad hoc meetings on the same topic may be made by the ad hoc meeting participants themselves without reference to the parent WG or TSG, although the parent WG or TSG shall review any ad hoc activity at every Ordinary meeting and determine to either continue or to close the ad hoc activity, even if the previous ad hoc meeting suggested a further meeting. The scope of each subsequent ad hoc meeting shall be indicated by the Chair at least 21 days before the meeting. The ad hoc meeting shall not expand or change the scope originally determined by the parent group. An ad hoc meeting is allowed to make decisions only within its pre-defined remit, and any such decisions shall be ratified by the parent WG or TSG unless, in the case of a WG, a decision was previously explicitly delegated by the WG to the ad hoc meeting.

An ad hoc meeting may be chaired as described for an ordinary meeting above, or, with the agreement of the WG or TSG concerned, by a Work Item rapporteur, or other appropriate person. Although open to all 3GPP Individual Members, ad hoc meetings may attract only a subset of Individual Member representatives who would normally participate in ordinary meetings.

Ad hoc meetings shall not be considered when calculating voting rights. That is, attendance at (or absence from) an ad hoc meeting shall not influence voting rights, which are determined solely by attendance at "ordinary" meetings.

No voting shall occur at ad hoc meetings.

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F.4 Attendance register

F.4.1 Face to face meetings

A delegate is deemed to have attended a given meeting if the individual confirms their participation by signing the attendance list made available by the group's secretary during the meeting. If a delegate does not sign the attendance sheet during the meeting, the secretary shall assume that the individual did not attend.

A delegate, having registered and begun to participate in a meeting, is not allowed to change their represented organization during the course of that meeting. An individual delegate is not allowed to simultaneously represent two or more Individual Members at a meeting.

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F.4.2 Electronic meetings

Electronic meetings such as audio / video conferences, email exchanges considered as meetings, etc, are encouraged where appropriate. For such events, the Secretary will establish the attendance list on the basis of those actually participating in the meeting (those dialling in to the conference bridge, those issuing and responding to emails, etc.) Nevertheless, advance registration is strongly encouraged.

Fully electronic meetings are to be considered as "ad hoc" as defined above.

Participation by Individual Member in fully electronic meetings, or electronic participation in a face to face meeting (eg by phoning in) is not considered for the accrual or loss of voting rights.

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Annex G: Working agreements

"Working agreements" are tentative decisions reached by 3GPP groups in order to make progress on matters where consensus (as defined in annex A) cannot be reached. It is intended to be used in situations where there is a clear majority in favour of one approach, but a small minority has sustained opposition to that approach.

The working agreement process has the following steps:

- Consensus cannot be reached on an issue. A substantial majority of individual members prefer a given approach, but there is sustained opposition by a small minority of individual members, preventing consensus.
- The Chair declares a working agreement. The working agreement is documented in the meeting report
- The approach agreed to by the majority and documented in the working agreement can continue unimpeded.
- The working agreement is entered into the 3GPP working agreements page on the 3GPP web site. The window for challenging the working agreement is now open.
- Working agreements may be challenged, resulting in a formal vote. This potential vote would be held at the next meeting of the WG or parent TSG (whichever comes first). If the next meeting is less than 14 days after the establishment of the working agreement, then that meeting is skipped in determining the next meeting. The meeting for potential voting is documented on the 3GPP working agreements page of the 3GPP web site (http://www.3gpp.org/TSG-Working-Agreements).
- The challenge cut-off date is established. This is 7 days before the start of the meeting for potential voting. The cut-off date is documented on the 3GPP working agreements page of the 3GPP web site.
- Organizations wishing to challenge the working agreement may do so until the challenge window closes. A challenge may be made by informing the Chair of the group which will do the voting. Any received challenge is documented on 3GPP working agreements page of the 3GPP web site.
- The group which will be voting is informed of the intention to have a working agreement challenge vote and the specific voting question.
- If no challenge is received by the challenge cut-off date, then the working agreement is confirmed. The confirmation of the working agreement is documented on the 3GPP working agreements page of the 3GPP web site. The issue is closed.
- If a challenge is received, then a formal vote on the working agreement will occur at the designated meeting. If the draft agenda for the designated meeting has already been issued, then it will be updated to include the potential for voting on the working agreement. Voting is as described in articles 25, 26 and 32 of the working procedures with the exception that the requirement for quorum is waived.
- If the challenge fails (at least 71% in favour of the working agreement), then the working agreement is confirmed. The confirmation of the working agreement is documented on the 3GPP working agreements page of the 3GPP web site. The issue is closed.
- If the challenge succeeds (less than 71% in favour of the working agreement), then the working agreement fails. All changes which were made based on the working agreement shall be reversed and the group must continue to search for consensus. The overturning of the working agreement is documented on the 3GPP working agreements page of the 3GPP web site.
- Organizations may withdraw a challenge at any time in the process. If the last challenge is withdrawn after the challenge cut-off, then the working agreement is confirmed. The confirmation of the working agreement is documented on the 3GPP working agreements page of the 3GPP web site. The issue is closed.

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Annex H: Calculation of quorum in TSGs and WGs

Where calculation of a quorum is required in the context of a vote conducted in a TSG or a WG, the quorum shall be deemed to have been met if:

$(B - P) / V >= Q$

Where:

B is the number of ballot papers issued;

P is the number of proxy votes exercised (i.e. the number of ballot papers issued to delegates bearing authorization to cast votes by proxy);

V is the number of Individual Members having the right to vote at the meeting (including those with only the right to vote “in person” and not by proxy);

Q is the required quorum value given in article 26.

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Annex I: Special procedures for exceptional situations restricting travel

3GPP working procedures are designed around the concept of periodic face to face meetings. This is not always possible. This annex implements modifications to the working procedures intended to allow 3GPP to function in the absence of face to face meetings. The PCG has the responsibility of activating and deactivating this annex.

The following changes in the working procedures are in effect when this annex is activated:

Article 14: PCG tasks

The following item shall be added to the list of PCG tasks:

- *maintenance of the voting and voting rights process integrity, to include disciplinary action if required.*

Article 22: TSG and WG election of Chair and Vice Chairs

The following paragraph is removed from section 22.2

If a WG does not meet physically with enough frequency to maintain an up to date voting list, the working group may elect to escalate the voting for officers to the parent TSG.

Article 26: TSG and WG voting during a meeting

The following additions to article 26 are in effect:

If voting occurs in the context of an Electronic Meeting, then:

- *Proxies are not allowed.*
- *Quorum does not apply.*
- *The voting period shall be a minimum of 18 consecutive hours excluding the period 12:00 UTC Friday to 11:59 UTC Monday which excludes Saturday and Sunday in every time zone. The use of 18:00 UTC to 12:00 UTC the next day is recommended for the voting period.*
- *The voting period shall commence no earlier than the start of the Electronic meeting and complete before the closure of the meeting. Voting for elections may exceptionally extend past the scheduled end of the meeting if additional rounds are required to complete the election of all open positions. Such elections are considered to be part of the meeting in which the elections started.*
- *The starting and closing times of the vote shall be clearly announced and disseminated to all on the principal TSG or WG membership mail exploder lists.*
- *The list of Voting Members (IMs that are eligible to vote) is as defined in article 35. Delegates vote on behalf of the IM under which they have registered, and only delegates checked in to the meeting may vote.*
- *If, in accordance with Article 25, the TSG or WG decides that a secret ballot is required, voting shall preserve the secrecy of the votes cast.*
- *A secure voting tool provided by the MCC shall be used for elections, and is also encouraged for other matters where voting is required.*

Article 28: TSG or WG voting for the election of TSG or WG Chair and Vice Chair

The following new paragraph is added to the end of article 28:

If an election is held during an electronic meeting, the voting shall use the voting procedures described in Article 26 as amended by this Annex.

Article 30: TSG and WG meetings

The following new paragraph is added after the 2nd paragraph of this article:

Electronic meetings are encouraged where appropriate.

Article 30A: TSG and WG participation

The text in article 30A shall be replaced with:

IMs wishing to progress work on topics in 3GPP are expected to participate in both face to face meetings and electronic meetings.

If a 3GPP IM is materially interested in a specific topic but is unable to participate in a meeting by sending a delegate, the IM is urged to engage the support of other IMs whose delegates will be present at the meeting to present its views. If this is not possible for any reason, the IM may advise the Chair of the situation and may provide documents supporting their position. The Chair may facilitate the introduction of these documents during the meeting and the record of the meeting can include the discussion and outcome. The option to engage the Chair is intended for exceptional situations. The Chair has the right to decline the request.

Article 32: TSG and WG meeting agenda

The following paragraph is added:

The draft agenda shall indicate the start and end dates and times of the meeting. The draft agenda shall indicate if the meeting counts toward maintenance of voting rights.

Article 35: TSG and WG Voting Membership List

35.3 Established TSGs and WGs

The text in section 35.3 shall be replaced with:

To qualify for the voting list it is necessary for at least one delegate of an Individual Member to fulfill the voting rights establishment provisions of article 35.4 for the group concerned, without being removed according to the provisions of article 35.4.

An individual member having attained voting rights according to clause 35.4 has the right to cast a vote by proxy (see article 26). Thus, an Individual Member may not cast a vote by proxy during a meeting at which it is not represented unless it had already attained voting rights as described in clause 35.4.

35.4 Removal from and instatement to voting list

The word *reinstatement* in the title of section 35.4 shall be replaced by *instatement*

The text in section 35.4 shall be replaced with:

An Individual Member shall be removed from the voting list when either of the following happens:

1. *The Individual Member is not represented at three consecutive face to face ordinary meetings of the group (TSG or WG),*
2. *The Individual Member is not represented in two consecutive ordinary meetings of the group (TSG or WG) of which at least one is electronic*

The right to vote shall be instated or reinstated for an Individual Member at either of the following events:

1. *the second face to face ordinary meeting which a delegate of the Individual Member attends without missing the number of consecutive face to face ordinary meetings mentioned in the previous paragraph,*
2. *the third consecutive ordinary meeting which a delegate of the Individual Member attends*

Note: See article 35.3 for eligibility to cast a proxy vote.

EXAMPLE 1: *If Individual Member Z is represented at face to face ordinary meeting K and K+3 (and is thus eligible to vote) but is not represented at face to face ordinary meetings K+4, K+5 and K+6, it is removed from the voting list.*

EXAMPLE 2: *If Individual Member X, not previously having been represented at an face to face ordinary meeting of the group, is represented at face to face ordinary meetings N and N+3, it may cast a vote at face to face ordinary meeting N+3.*

NOTE: *Individual Member X might choose to cast a vote by proxy at face to face ordinary meeting N+3, even though its delegate is physically present. This is sometimes useful for coordinating company positions where one large company has several Individual Memberships, possibly via several different Organizational Partners.*

EXAMPLE 3: *If Individual Member Y, not previously having been represented at a meeting of the group, is represented at ordinary meeting N only, it may not cast a vote by proxy at ordinary meeting N+2.*

EXAMPLE 4: *If Individual Member A is represented at electronic ordinary meetings N, N+1, and N+2 (and is thus eligible to vote) but is not represented at electronic ordinary meetings N+3 and N+4, it is removed from the voting list.*

EXAMPLE 5: *If Individual Member B, not previously having been represented at an ordinary meetings of the group, is represented at electronic ordinary meetings N, N+1, and N+2, it may cast a vote at electronic ordinary meeting N+2.*

35.5 (Void)

The contents of this section shall be struck and the heading replaced with VOID.

The following subclause is added to Article 35:

35.6 OP Voting Rights Hardship Exemption

For an IM belonging to an OP that has a voting rights hardship exemption for a given meeting, then missing the meeting is not counted in the voting rights algorithm. (In other words, for that IM, it is treated as though the meeting did not occur). If an IM covered by a voting rights hardship exemption for voting rights does attend the meeting, then it is counted as normal attendance.

If an IM covered by voting rights hardship exemption misses a meeting, there will be a permanent record (e.g., in the relevant meeting report) to note the list of IMs who have the voting rights hardship exemption for that meeting, and the voting rights list will also indicate the voting rights hardship exemption for the relevant meeting.

Voting rights hardship exemptions are granted on a per OP, per meeting basis.

Annex A: Definitions

The following 4 definitions are added:

Ad hoc Meeting	*A meeting called to address one or more particular topics that is not an ordinary meeting (see F.3)*
Electronic meeting:	*A electronic meeting is one where all the participants connect to the meeting using electronic means such as audio/video conference, email, etc.*
Face to face meeting:	*A face to face meeting, also referred to as a physical meeting, is one held at a designated physical location where participants are invited to attend in person.*
Ordinary Meeting	*A meeting where the ordinary business of a group is conducted (see F.2).*

Annex F: Guidance on meeting organization

The title of Annex F shall be changed to Guidance on TSG and WG meeting Organization

F.2 Ordinary meetings

The contents of clause F.2 shall be replaced with the following:

Ordinary meetings are ones where the regular business of the TSG or WG is conducted. Such meetings are normally chaired by the Group's Chair or, if unavailable, a Vice Chair. Ordinary meetings should be announced at least six months prior to the opening day of the meeting. An ordinary meeting may be held as a face to face meeting or as an electronic meeting.

TSG and WG ordinary meetings shall follow an incrementing number sequence. If an additional ordinary meeting is required between two ordinary meetings, the sequence may be preserved, even though this means renumbering subsequent meetings, or the additional meeting may be numbered using the 'bis' suffix as a numbering scheme. Ordinary meetings that are held electronically shall be designated with an 'e' suffix.

Attendance at an ordinary meeting counts towards an Individual Member's eligibility to cast a vote in the Group (see articles 26 and 27). The Support Team shall record the participation in an ordinary meeting (each person and organization represented) and the attendance list shall be included in the meeting report.

If a meeting is designated as face to face, provisions to support remote participation (e.g. by using additional audio/video capabilities) would be at the discretion of the host and leadership. In a meeting designated as face to face, those participating remotely are not to be counted toward quorum or attendance, and are not allowed to vote.

Following each ordinary meeting, the Support Team shall publish a list of IMs that have gained or lost voting rights at that meeting.

F.3 Ad hoc meetings

The contents of clause F.3 shall be replaced with the following:

An ad hoc meeting of a WG or a TSG is one called to address one or more particular topics. An ad hoc meeting may be held as a face to face or as an electronic meeting. The ad hoc meeting shall be called by decision of the WG (or its parent TSG) or TSG concerned; the decision to hold any subsequent ad hoc meetings on the same topic may be made by the ad hoc meeting participants themselves without reference to the parent WG or TSG, although the parent WG or TSG shall review any ad hoc activity at every Ordinary meeting and determine to either continue or to close the ad hoc activity, even if the previous ad hoc meeting suggested a further meeting. The scope of each subsequent ad hoc meeting shall be indicated by the Chair at least 21 days before the meeting. The ad hoc meeting shall not expand or change the scope originally determined by the parent group. An ad hoc meeting is allowed to make decisions only within its pre-defined remit, and any such decisions shall be ratified by the parent WG or TSG unless, in the case of a WG, a decision was previously explicitly delegated by the WG to the ad hoc meeting.

An ad hoc meeting may be chaired as described for an ordinary meeting above, or, with the agreement of the WG or TSG concerned, by a Work Item rapporteur, or other appropriate person. Although open to all 3GPP Individual Members, ad hoc meetings may attract only a subset of Individual Member representatives who would normally participate in ordinary meetings.

Ad hoc meetings shall not be considered when calculating voting rights. That is, attendance at (or absence from) an ad hoc meeting shall not influence voting rights, which are determined solely by attendance at "ordinary" meetings.

No voting shall occur at ad hoc meetings.

F.4 Attendance Register

The contents of clause F.4 (and subclauses) shall be replaced with the following:

A delegate is deemed to have attended a given meeting if the individual confirms their participation by checking in. If a delegate does not check in during the meeting, the secretary shall assume that the individual did not attend. Checking in must be performed between the start and end of the meeting. In addition, the check in process shall clearly inform the delegate that 'Checking in carries the responsibility for participating in relevant parts of the meeting'.

A delegate, having registered and checked in to a meeting, is not allowed to change their represented organization during the course of that meeting. An individual delegate is not allowed to simultaneously represent two or more Individual Members at a meeting.

F.4.1 (void)

F.4.2 (void)

Annex G: Working agreements

The following changes to Annex G are in effect:

Challenge votes may be conducted at Electronic meetings provided they are Ordinary meetings.

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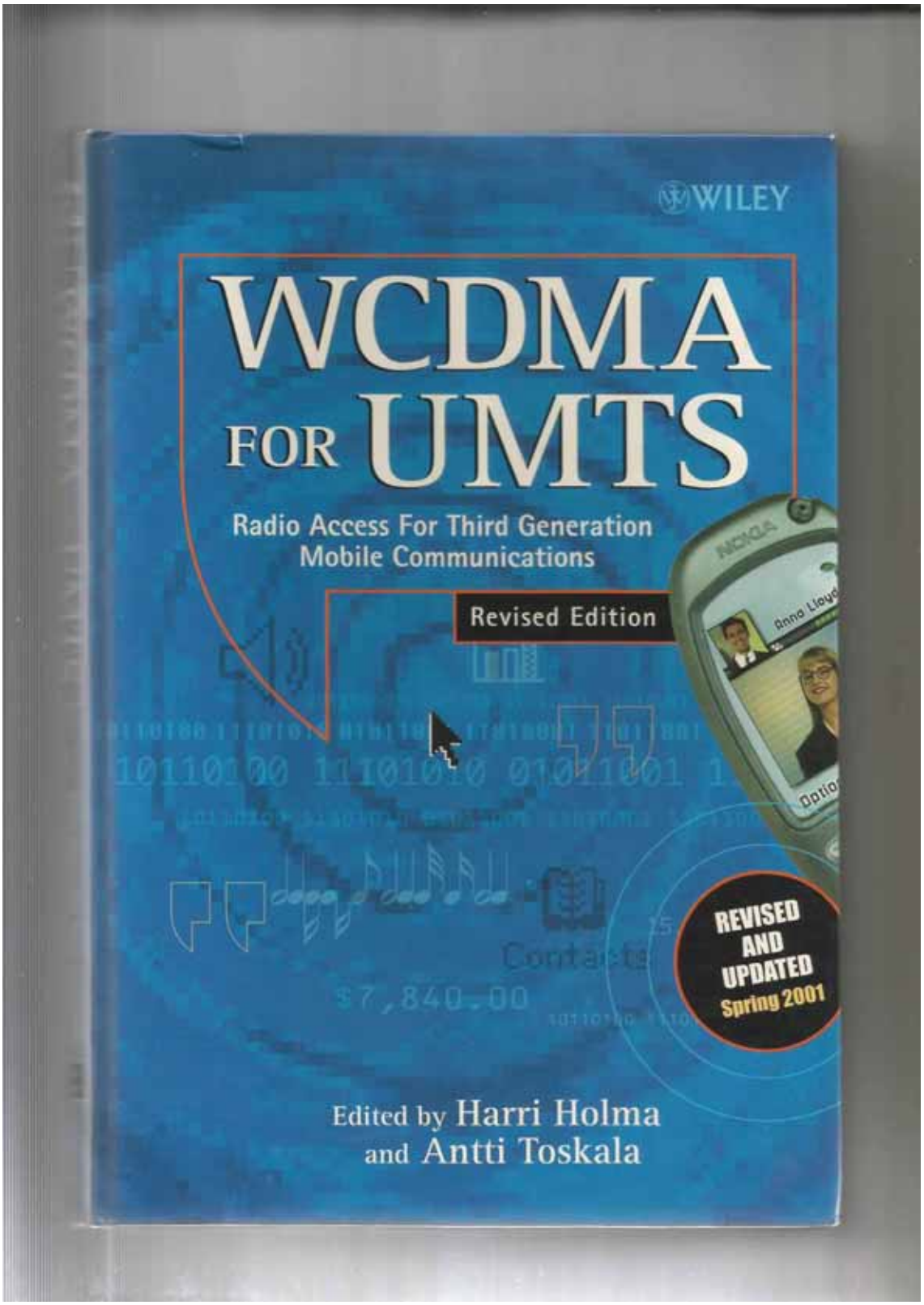
Annex J: Change history

Date	PCG #	PCG Doc.	CR	Rev	Subject/Comment
2002-04-25	6				
2005-03-01	13				Changes agreed at PCG meeting incorporated. [No formal change control system yet in place]
2006-04-24	16	PCG16_07	2		ETSI proposal: Article 10 Clarify the rights of observers and guests
			3		ETSI proposal: Article 15 To allow leeway in the number of delegates representing each OP at PCG (To reflect the decision already taken by PCG#14 on PCG participation)
			9		ETSI proposal: Article 34 To cater for current TSG structure and to reflect common practice of Tdoc numbering
			1	1	Article 3 Reflect decision on regional options (To incorporate PCG#7 decision)
			4	1	Article 22 Clarification and codification of the rights to stand for elected positions in TSGs and WGs
			8		Article 30 & annex F Inclusion of an annex giving guidance on meeting organization
2006-10-27	17	PCG17_15 r1	10		Article 35 Clarification of voting rights
2009-05-18	22	PCG22_18	11	5	Changes resulting from the OP ad hoc group on improvements report and conclusions of OP#20. Articles affected: 22 23 31 35 41 52 Annex D plus sundry spelling corrections.
		PCG22_19	12	2	Rules on eligibility to cast votes at TSG and WG level.
		PCG22_20	13		Bring statement of purpose of 3GPP up to date
		PCG22_23	14		Adding Working Agreements to working procedures
		PCG22_30 r3	15	3	Change of ITU liaison process Note: PCG meeting #22 approved contribution PCG22_30r1 but this was subsequently revised to r3 after the meeting with the apparent approval of the PCG.
					Decision PCG22/11: clause 22.1 changed wording from "in the March time frame in" to "in the first semester of".
2009-08-12					Editorial correction to implementation of CR15r3. (article 52).
2010-04-23	24	PCG24_11	16		TSG vs WG election
		PCG24_12	17		Quorum
		PCG24_13	18		Communication with ITU
		PCG24_25	19		Attendance register for meetings
2012-10-24		PCG29_17	20		Update to 3GPP Working Procedures article 22
2014-07-22	33	PCG33_10	21		Anti-trust / competition law requirements articles 12, 17, 22.1, 23, 29, 59A, annex C
2014-12-31	34	PCG34_14	22		Anti-trust recommendations v1.1.
					Addition of TSDSI to list of OPs in annexes B and C. Minor formatting and spelling corrections, consistent capitalization.

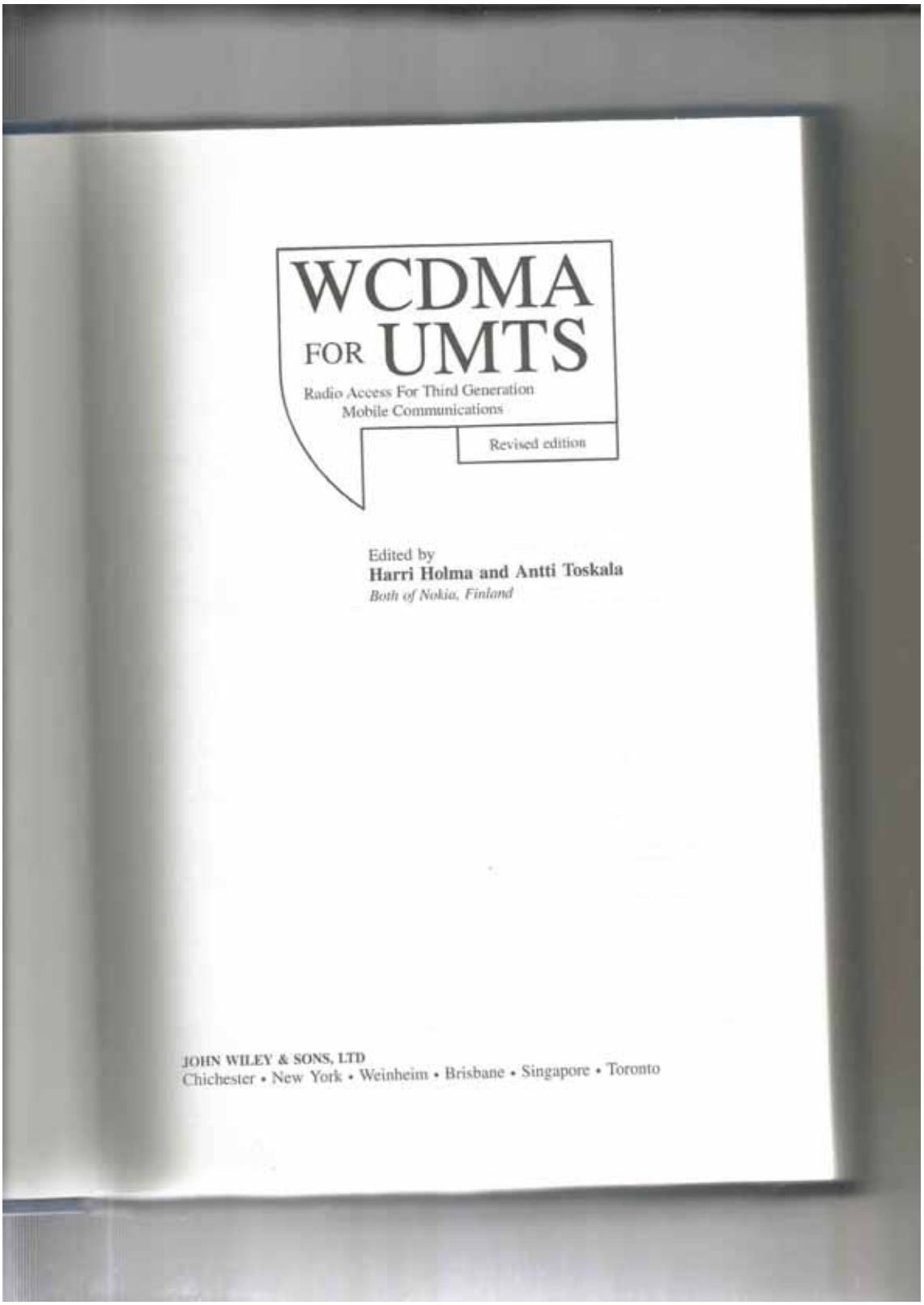
2016-11-15	35	PCG37_14	23		Article 22.1 Modification to clarify obligation on elected officials regarding antitrust/competition law training.
2019-08-22	42	(none)	24		Article 55 Correction of text to reflect actual practice. Note: Decision taken by email in response to Action PCG42/7.
2019-08-23	42	PCG42_18	25		Article 22.2 Adds text allowing WGs which meet infrequently to escalate elections of their officials to the parent TSG. Article 25 Adds text allowing WGs which meet infrequently to escalate technical votes to the parent TSG. Article 30A (new) Introduces procedures for situations where an IM is unable to send a delegate in person to a meeting but nevertheless wishes to contribute to the proceedings. Secretary's note 1: Annex B Added abbreviation 'IM', though this was not included in PCG42_18. Secretary's note 2: Corrected the CR numbers in the previous two change history entries.
2020-02-07	43	PCG43_14			Annex G: Removal of the statement that voting on working agreements was to be a standard element of every meeting agenda. Addition of a reference to article 32. Removal of the requirement for a quorum during voting on working agreements.
2020-05-15	44				Addition of "crisis annex"
2020-09-30	45	PCG45_11			Update to 3GPP Working Procedures Annex I ("crisis annex")
2021-04-29	46	PCG46_20			Decision PCG46/09: Gender Neutrality Changes Annex I Change minimum voting window from 24 to 18 hours
2022-03-07	48	PCG48_12			Voting Rights pCR to Annex I
2022-03-07	48	PCG48_13			Hardship Exemption pCR to Annex I
2022-09-01	49	-			Working Procedures P-CR for Registration

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APPENDIX 6



Petitioners' Exhibit 1007, p. 161
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121



WCDMA FOR UMTS

Radio Access For Third Generation Mobile Communications

Revised edition

Edited by
Harri Holma and Antti Toskala
Both of Nokia, Finland

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4.5.3 cdma2000

The cdma2000 air interface proposal to ITU is the result of work in TR45.5 on the evolution of IS-95 towards the third generation. The cdma2000 proposal is based partly on IS-95 principles with respect to synchronous network operation, common pilot channels, and so on, but it is a wideband version with three times the bandwidth of IS-95. The ITU proposal contains further bandwidth options as well as the multi-carrier option for downlink. The cdma2000 proposal has a high degree of commonality with the Global CDMA 1 ITU proposal from TTA, Korea.

The cdma2000 multi-carrier option is covered in more detail in Chapter 13, as being currently standardised by 3GPP2.

4.5.4 TR46.1

The WIMS W-CDMA was not based on work derived from an existing second generation technology but was a new third generation technology proposal with no direct link to any second generation standardisation. It was based on the constant processing gain principle with a high number of multicodes in use, thus showing some fundamental differences but also a level of commonality with WCDMA technology in other forums.

4.5.5 WP-CDMA

WP-CDMA (Wideband Packet CDMA) resulted from the convergence between W-CDMA N/A of T1P1 and WIMS W-CDMA of TR46.1 in the US. The main features of the WIMS W-CDMA proposal were merged with the principles of W-CDMA N/A. The merged proposal was submitted to the ITU-R IMT-2000 process towards the end of 1998, and to the 3GPP process at the beginning of 1999. Its the most characteristic feature, compared with the other WCDMA-based proposals, was a common packet mode channel operation for the uplink direction, but there were also a few smaller differences.

4.6 Creation of 3GPP

As similar technologies were being standardised in several regions around the world, it became evident that achieving identical specifications to ensure equipment compatibility globally would be very difficult with work going on in parallel. Also, having to discuss similar issues in several places was naturally a waste of resources for the participating companies. Therefore initiatives were made to create a single forum for WCDMA standardisation for a common WCDMA specification.

The standardisation organisations involved in the creation of the 3rd Generation Partnership Project (3GPP) [9] were ARIB (Japan), ETSI (Europe), TTA (Korea), TTC (Japan) and T1P1 (USA) as shown in Figure 4.2. The partners agreed on joint efforts for the standardisation of UTRA, now standing for Universal Terrestrial Radio Access, as distinct from UTRA (UMTS Terrestrial Radio Access) from ETSI, also submitted to 3GPP. Companies such as manufacturers and operators are members of 3GPP through the respective standardisation organisation to which they belong.

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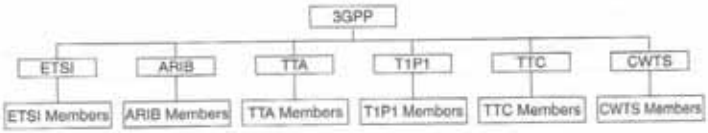


Figure 4.2. 3GPP organisational partners

Later during 1999, CWTS (the China Wireless Telecommunication Standard Group) also joined 3GPP and contributed technology from TD/SCDMA, a TDD-based CDMA third generation technology already submitted to ITU-R earlier.

3GPP also includes market representation partners: GSM Association, UMTS Forum, Global Mobile Suppliers Association, IPv6 Forum and Universal Wireless Communications Consortium (UWCC). In [9] there are up-to-date links to all participating organisations.

The work was initiated formally at the end of 1998 and the detailed technical work was started in early 1999, with the aim of having the first version of the common specification, called Release-99, ready by the end of 1999.

Within 3GPP, four different technical specification groups (TSG) were set up as follows:

- Radio Access Network TSG
- Core Network TSG
- Service and System Aspects TSG
- Terminals TSG

Within these groups the one most relevant to the WCDMA technology is the Radio Access Network TSG (RAN TSG), which has been divided into four different working groups as illustrated in Figure 4.3.

The RAN TSG will produce Release-99 of the UTRA air interface specification. The work done within the 3GPP RAN TSG working groups has been the basis of the technical description of the UTRA air interface covered in this book. Without such a global initiative, this book would have been forced to focus on a single regional specification, though with many similarities to those of other regions. Thus the references throughout this book are to the specification volumes from 3GPP.

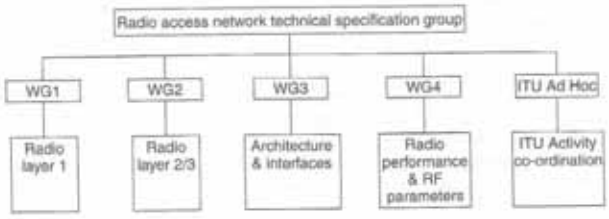


Figure 4.3. 3GPP RAN TSG working groups

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During the first half of 1999 the inputs from the various participating organisations were merged in a single standard, leaving the rest of the year to finalise the detailed parameters for the first full release, Release-99, of UTRA from 3GPP. The member organisations have undertaken individually to produce standard publications based on the 3GPP specification. Thus, for example, the Release-99 UMTS specifications from ETSI are identical to the Release-99 specifications produced by 3GPP. The latest specifications can be obtained from 3GPP [9].

During 2000, further work on GSM evolution was moved from ETSI and other forums to 3GPP, including work on GPRS and EDGE. A new TSG, TSG GERAN was set up for this purpose.

4.7 Creation of 3GPP2

Work done in TR45.5 and TTA was merged to form 3GPP2, focused on the development of cdma2000 Direct-Sequence (DS) and Multi-Carrier (MC) mode for the cdma2000 third generation component. This activity has been running in parallel with the 3GPP project, with participation from ARIB, TTC and CWTS as member organisations. Recently the main concentration has been on the MC mode work, due to decisions resulting from the global harmonisation efforts.

4.8 Harmonisation Phase

During the spring of 1999 several operators and manufacturers held series of meetings to seek further harmonisation and convergence between the CDMA-based third generation solutions, WCDMA and cdma2000. For the 3GPP framework the ETSI, ARIB, TTA and T1P1 concepts had already been merged to a single specification, while cdma2000 was still on its own in TR45.5. As a result of several meetings and telephone conferences, the manufacturers and operators agreed to adopt a harmonised global third generation CDMA standard consisting of three modes: Multi-Carrier (MC), Direct Spread (DS) and Time Division Duplex (TDD). The MC mode was based on the cdma2000 multi-carrier option, the DS mode on WCDMA (UTRA FDD), and the TDD mode on UTRA TDD. The agreement was to phase in a modular approach in which both core networks could be used with all air interface alternatives, as described in Figure 1.4 in Chapter 1.

The main technical impacts of these harmonisation activities were the change of UTRA FDD and TDD mode chip rate from 4.096 Mcps to 3.84 Mcps and the inclusion of a common pilot for UTRA FDD. The work in 3GPP2 focused on the MC mode, and the DS mode from cdma2000 was abandoned. The result is that globally there is only one Direct Spread (DS) wideband CDMA standard, WCDMA.

4.9 IMT2000 Process in ITU

In the ITU, recommendations have been developed for third generation mobile communications systems, the ITU terminology being called IMT-2000 [10], formerly FPLMTS. In the ITU-R, ITU-R TG8/1 has worked on the radio-dependent aspects, while the radio-independent aspects have been covered in ITU-T SG11.

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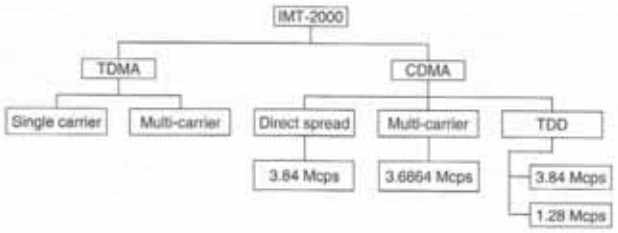


Figure 4.4. ITU-R IMT-2000 grouping

In the radio aspects, ITU-R TG8/1 received a number of different proposals during the IMT-2000 candidate submission process. In the second phase of the process, evaluation results were received from the proponent organisations as well as from the other evaluation groups that studied the technologies. During the first half of 1999 recommendation IMT.RKEY was created which describes the IMT-2000 multimode concept.

The ITU-R IMT-2000 process was finalised at the end of 1999, when the detailed specification (IMT-RSCP) was created and the radio interface specifications were approved by ITU-R [11]. The detailed implementation of IMT-2000 will continue in the regional standards bodies. The ITU-R process has been an important external motivation and timing source for IMT-2000 activities in regional standards bodies. The requirements set by ITU for an IMT-2000 technology have been reflected in the requirements in the regional standards bodies, for example in ETSI UMTS 21.01 [5], in order for the ETSI submission to fulfil the IMT-2000 requirements. The ITU-R interaction between regional standardisation bodies in the IMT-2000 process is reflected in Figure 4.5.

The ITU-R IMT-2000 grouping, with TDMA- and CDMA-based groups, is illustrated in Figure 4.4. The UTRA FDD (WCDMA) and cdma2000 are part of the CDMA interface, as CDMA Direct Spread and CDMA Multi-Carrier respectively. UWC-136 and DECT are part of the TDMA-based interface in the concept, as TDMA Single Carrier and TDMA Multi-Carrier respectively. The TDD part in CDMA consists of UTRA TDD from 3GPP and TD-SCDMA from CWTS. For the FDD part in the CDMA interface, harmonisation has been completed, and the harmonisation process is expected to continue for the CDMA TDD mode within 3GPP during 2000 and 2001.

4.10 Beyond 3GPP Release-99

Upon completion of the Release-99 specifications, work will concentrate on specifying new features as well as making the necessary corrections to Release-99. Typically such corrections arise as implementation proceeds and test systems are updated to include the latest changes in the specifications. As experience in various forums has shown, a major step forward in system capabilities with many new features requires a phasing-in period for the specifications. Fortunately, the main functions have been verified in the various test systems in operation since 1995, but only the actual implementation will reveal any errors and inconsistencies in the fine detail of the specifications.

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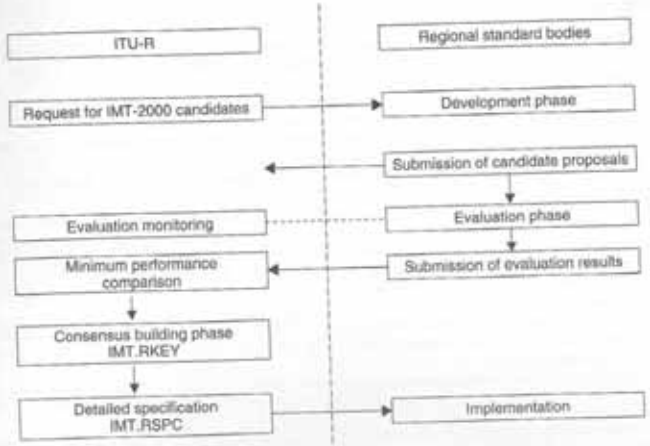


Figure 4.5. Relationship of ITU-R to the regional standards bodies

In 3GPP the next version of the specifications was originally considered as Release 2000, but since that the Release naming was adjusted so that next release is called Release 4 due to the 03/2001. Release 4 will contain only minor adjustment with respect to the Release'99. Bigger items are foreseen for inclusions in Release 5, including reaching for the data rates even up to the 10 Mbps in the downlink direction. Release 5 is due for the end of 2001. Release'99 specifications have a version number starting with 3 while Release 4 and 5 specifications have version number starting logically with 4 and 5 respectively.

During coming years, part of the process is to specify the extensions for connecting UTRA FDD to IS-41 based core networks. Work will be carried out on cdma2000 to allow connection to GSM-based core networks. This development will offer operators some degree of flexibility in selecting their third generation technology, assuming they are not aiming to launch such a service immediately, since Release-99 does not yet contain these options.

On the TDD side, further alignment is expected between the TDD mode in UTRA and the TDD mode from CWTS (China). This process is expected to continue after Release-99 is completed in 3GPP. 3GPP Release-4 is also planned to cover the lower chip rate (1.28 Mcps) TDD.

Other interesting developments are expected in the area of using IP based technology in UTRA. First step is going to be the IP based transport option in Release 4 and further releases are likely to see IP technology shaping the internal architecture of the UTRA Network (UTRAN). Also some of the protocols developed by the Internet Engineering Task Force (IETF) [12], such as robust IP header compression suitable for cellular transmission, are foreseen to be adopted as part the UTRA Rel'4 specifications.

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[12] http://www.ietf.org

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APPENDIX 7

3GPP PCG#36
Delhi, 28 April 2016
PCG36_18

MCC Activity Report

Source

Adrian Scrase

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Contents

- Departures and Arrivals
- Resource Allocation
- Workload
- 3GPP Membership
- 3G Ultimate Project
- Antitrust Compliance Training
- Summary and Outlook

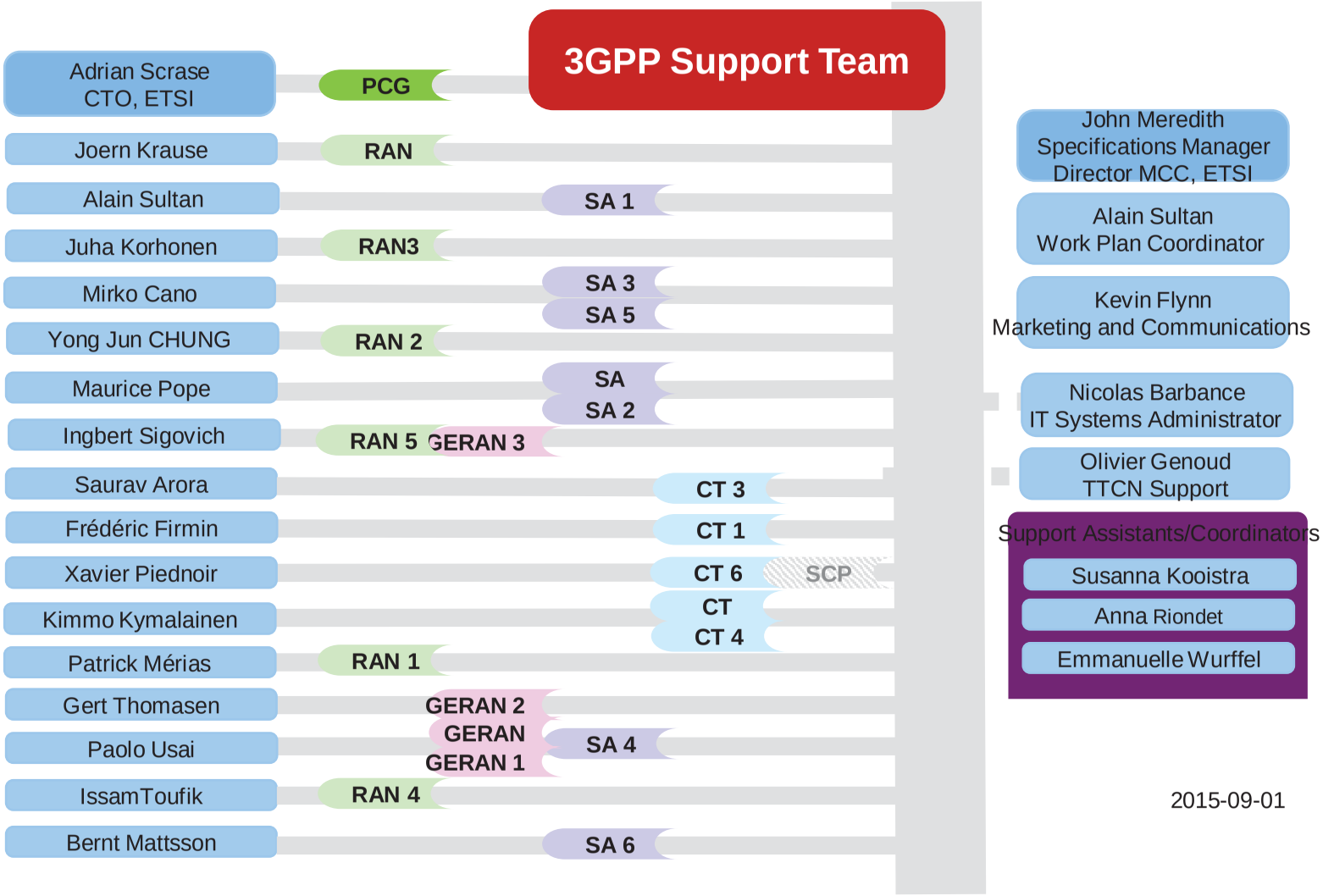
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Departures and Arrivals

There have been no departures or arrivals since PCG#35

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Current Resource Allocation



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Workload

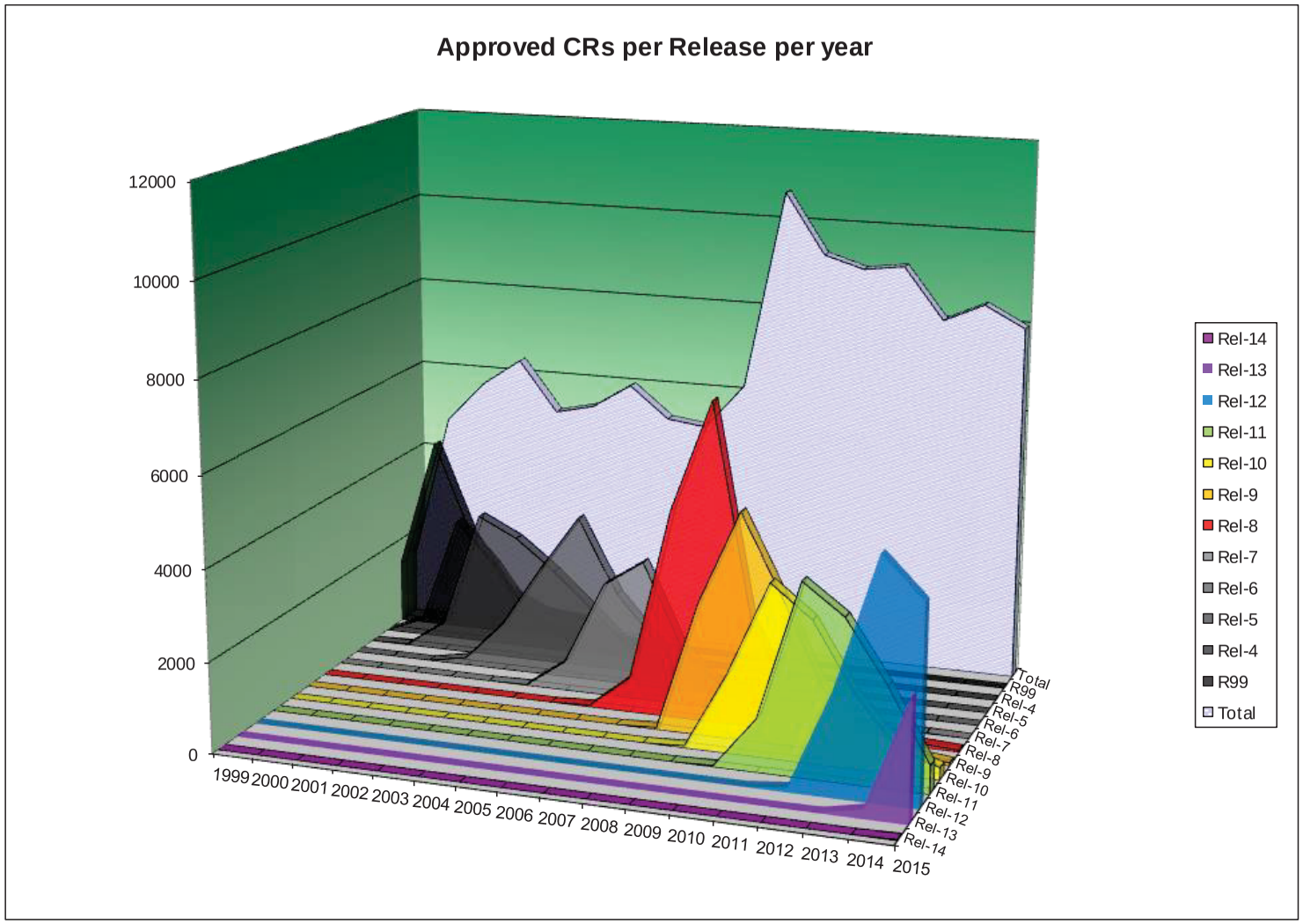
Approved CRs per Release per Year

Release	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
R99	1408	4398	2266	1004	581	512	111	42	23	5	5	1	0					**10356**
Rel-4		376	2828	1900	690	257	122	63	48	22	20	13	11	8	7	2		**6367**
Rel-5		27	644	3274	2842	2162	1357	509	94	25	22	7	7	5	3	2		**10980**
Rel-6				172	1088	2458	3721	2074	1078	212	74	19	17	10	4	4		**10931**
Rel-7					1	20	663	2529	3132	1262	492	176	91	43	25	15		**8449**
Rel-8								49	777	4609	7073	2347	706	347	184	91	46	**16229**
Rel-9										49	2918	4991	3252	1366	376	165	70	**13187**
Rel-10											47	1722	3800	3103	1636	584	267	**11159**
Rel-11												32	1152	4178	3525	2186	622	**11695**
Rel-12													6	102	2254	5181	4287	**11830**
Rel-13															8	200	2648	**2856**
Rel-14																	24	**24**
Total	**1408**	**4801**	**5738**	**6350**	**5202**	**5409**	**5974**	**5266**	**5152**	**6184**	**10651**	**9308**	**9042**	**9162**	**8022**	**8430**	**7964**	114063

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Workload

Approved CRs per Release per Year



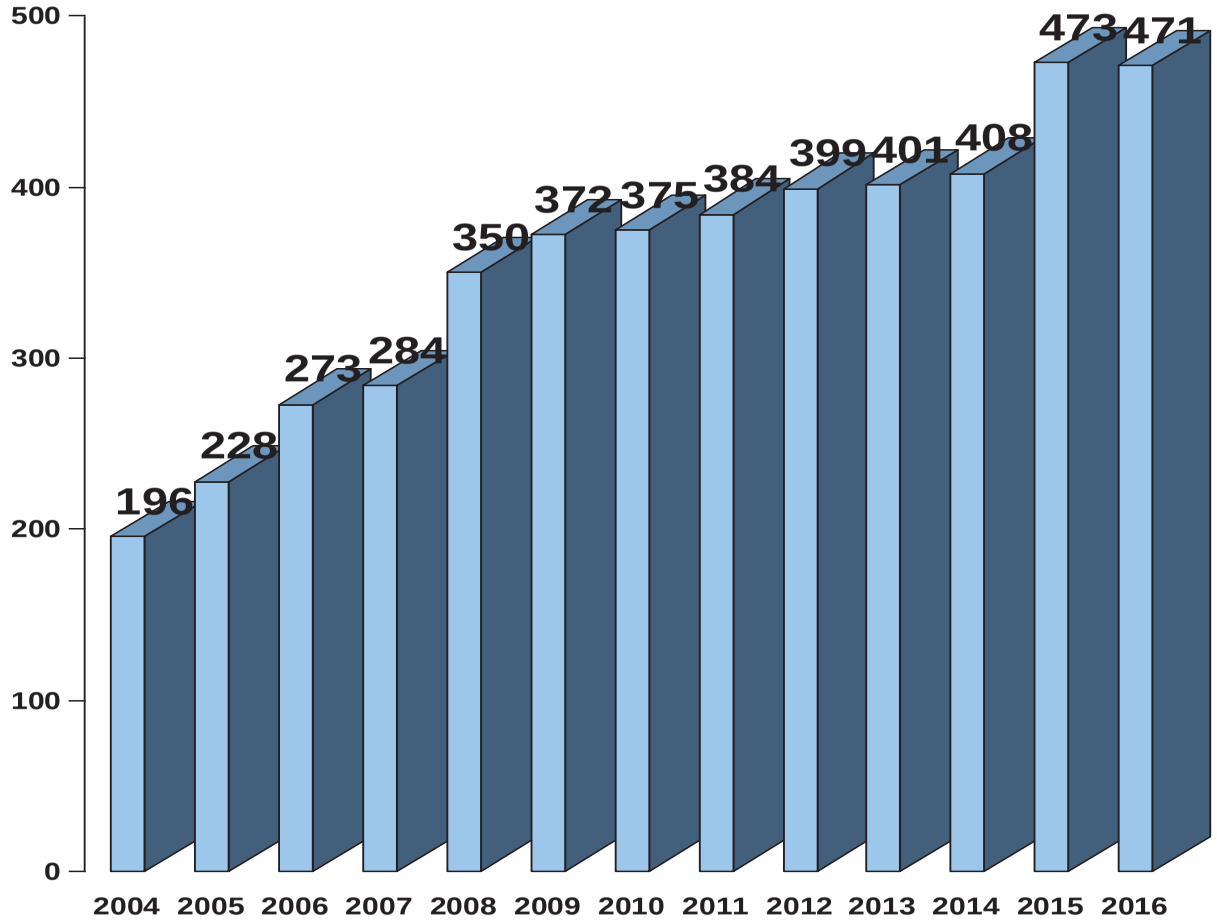
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3GPP Membership

3GPP Membership currently stands at *471* Individual Members. In addition, there are 22 companies having Guest Status, which are potential IMs

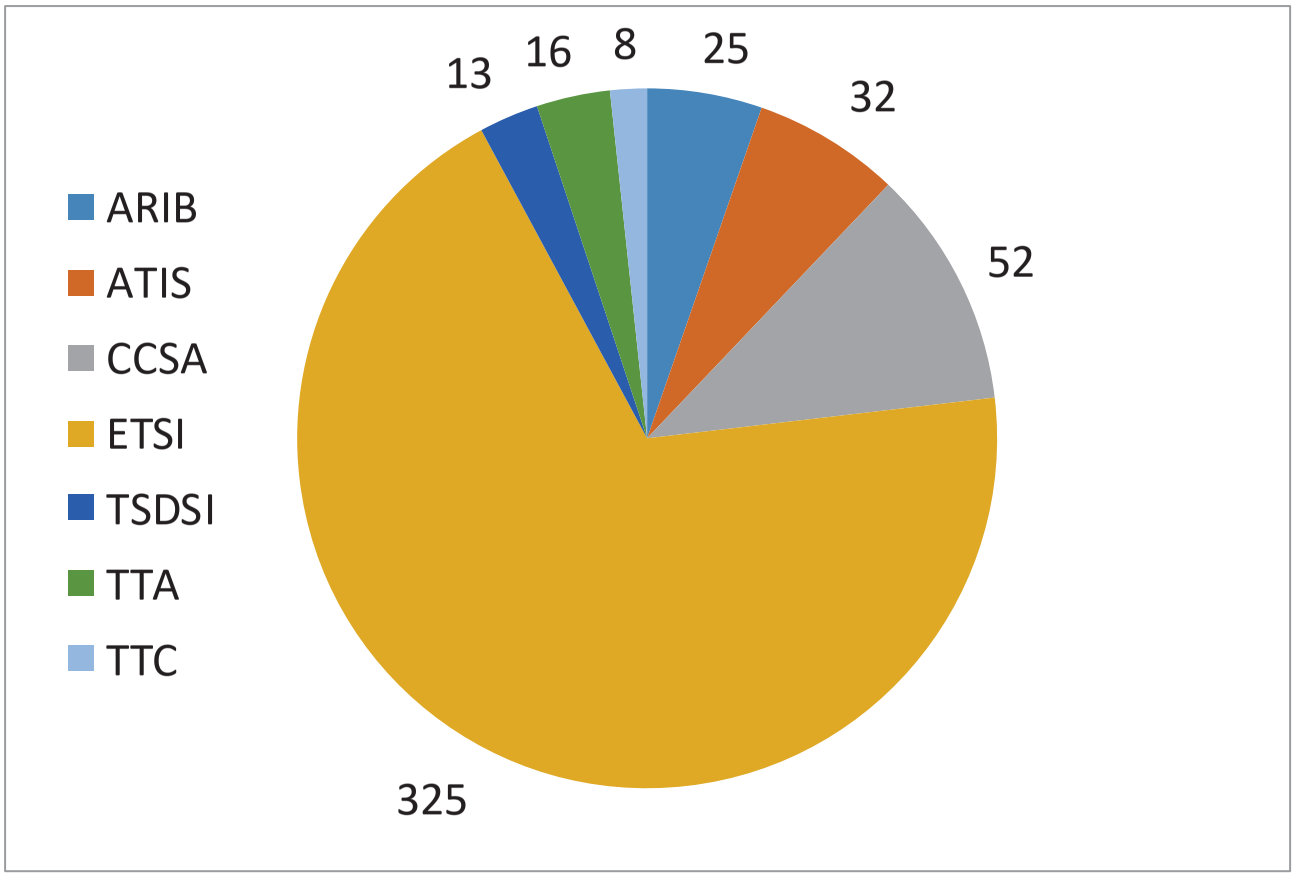
Number of Individual Members in 3GPP

3GPP Individual Members come from 45 Countries worldwide



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Individual Members in 3GPP



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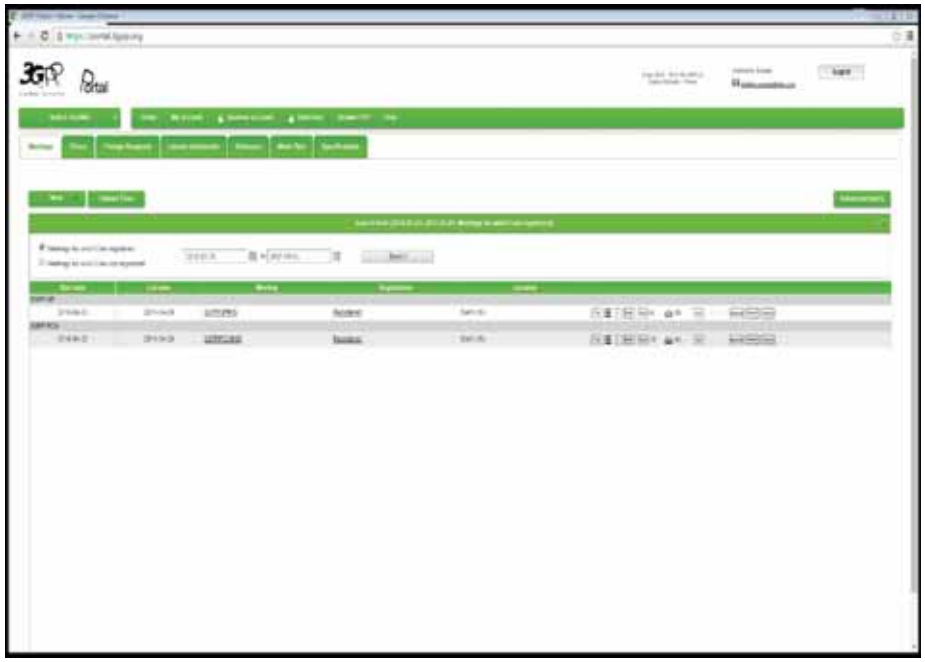
3GPP Ultimate Project (3GU)

3GU (http://portal.3gpp.org) is now in use by all groups (including the PCG!). The current version is 1.2, which went live on schedule in late February 2016.

This version fixes a number of bugs (unfortunately, not all), and provides a much more user friendly interface – for example, a user's search selection in a given tab is persistent and does not have to be typed in afresh each time the user moves to another tab then returns.

MCC is currently writing an on-line help for 3GU.

(You can check the work in progress at http://www.3gpp.org/specifications-groups/3gu-help .)



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Antitrust Training

Some delay has been experienced in bringing the training course on Antitrust and Competition Law to conclusion. However, it is hoped that the course material will be available shortly. As promised previously, the material will be circulated to the Organizational Partners so that the regional specifics can be validated before the training courses are put into effect.

Once the material has been validated, a number of online sessions will be planned that are convenient for each of the three regions.

More details will follow in due course.

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Support to ad hoc groups

The current MCC service level is based on the assumption that ad hoc meetings will not receive MCC support (unless those meetings are held at the ETSI HQ)

More recently, MCC has provided support to a number of ad hoc meetings (e.g. SA1-Smarter) where these ad hoc meetings have been considered to be of significant importance (based on a rather subjective assessment).

The start of next generation (5G) work is likely to give rise to more ad hoc meetings in the coming years.

The result of the flexible approach outlined above has been to overspend the budget, as these ad hoc meetings have not been taken into account when the annual budget was originally set.

PCG guidance would be appreciated on the approach to be taken in the future for MCC support of ad hoc meetings, e.g.:

- Retain the current approach, at the risk of exceeding the annual budget
- Allocate an annual budget for ad hoc meeting support (with clear criteria)
- Conclude that ad hoc meetings will not receive MCC support

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Proposed support to SA3-LI

TSG SA has requested that MCC support be provided to SA3 WG LI in the same manner as regular 3GPP Working Groups (PCG36_13).

SA3-LI meets approximately 4 times per year (2 European, 2 International).

It is estimated that support to SA3-LI would require 0,4 Officer.

The estimated cost of providing this support is as follows:

Loaded manpower cost:	50kEUR
Overhead charge (0.39%):	20kEUR
Travel and subsistence:	10kEUR
Total	80kEUR

This information may be useful in understanding the financial consequences

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3GPP Working Hours

Due to increasing workload, there is a tendency for 3GPP meetings to increase in duration. With the start of work on a next generation system, the workload is likely to increase further.

One noticeable occurrence was the meeting of RAN1#83 (Anaheim) which ran for 8 consecutive days. Moreover, the length of those days exceeded 12 hours duration.

MCC would like to recommend that 3GPP meetings:

- be no longer than 5 consecutive days duration,
- have a minimum of 11 hours break between the close of one meeting day and the start of the next.

If 3GPP Working Groups do wish to work in excess of the recommendations made above, then additional support resources will be required which will have obvious financial consequences

(It maybe noted that the labour laws of many countries in which 3GPP members are based, prohibit delegates from working excessive hours)

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Summary and Outlook

3GPP Membership has stabilised at about 470 companies, but the geographical reach is increasing (now at 45 countries).

3GPP faces the daunting task of delivering a set of specifications for a next generation (5G) system by December 2019 (with a preliminary set of specifications being delivered already by 2018). This is very likely to result in more meetings, increasing workload and some difficult discussions.

Improvements in 3GPP tooling are well underway and should hopefully increase the efficiency of 3GPP meetings.

Care is needed to ensure that, despite the increasing workload, 3GPP remains an effective project that continues to deliver a high quality product.

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APPENDIX 8

The 3G IP Multimedia Subsystem (IMS)

Merging the Internet and the Cellular Worlds

Gonzalo Camarillo and Miguel A. García-Martín

Both of
Ericsson, Finland



John Wiley & Sons, Ltd

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Chapter 2

The History of the IMS Standardization

In Chapter 1 we mentioned that the IMS uses Internet protocols. When the IMS needs a protocol to perform a particular task (e.g., to establish a multimedia session), the standardization bodies standardizing the IMS take the Internet protocol intended for that task and specify its use in the IMS. Still, no matter how simple this may sound the process of choosing protocols to be used in the IMS can sometimes get tricky. Sometimes, the Internet protocol that is chosen lacks some essential functionality, or does not even exist at all. When this happens the IMS standardization bodies contact the standardization body developing Internet protocols to work together on a solution. We will cover this collaboration in Section 2.5. Nevertheless, before jumping into that we will introduce in Section 2.1 all the standardization bodies involved in IMS development. We need to know who is who and which functions of the IMS each of them performs.

2.1 Relations between IMS-related Standardization Bodies

The ITU (International Telecommunication Union) IMT-2000 (International Mobile Telecommunications-2000) is the global standard for 3G (third generation) networks. IMT-2000 is the result of the collaboration between different standards bodies and aims at providing access to telecommunication services using radio links, which include satellite and terrestrial networks.

We will focus on two of the standard bodies involved in IMT-2000: 3GPP (Third Generation Partnership Project) and 3GPP2 (Third Generation Partnership Project 2). Still, they are not the only ones working within IMT-2000. Other bodies, such as the ITU-R (ITU-Radiocommunication Sector), for instance, are also involved in IMT-2000 but on different areas than the IMS.

Both 3GPP and 3GPP2 have standardized their own IMS (IP Multimedia Subsystem). The 3GPP IMS and the 3GPP2 IMS are fairly similar, but, nevertheless, have a few differences (Appendix A lists the most important differences).

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An important similarity between the 3GPP IMS and the 3GPP2 IMS is that both use Internet protocols, which have been traditionally standardized by the IETF (Internet Engineering Task Force). Consequently, both 3GPP and 3GPP2 collaborate with the IETF in developing protocols that fulfill their requirements. The following sections introduce the IETF, 3GPP, and 3GPP2 and provide a brief history of the IETF-3GPP/3GPP2 collaboration.

In addition to the standard bodies we have just mentioned, OMA (Open Mobile Alliance [144]) will play an important role in developing IMS services in the near future. While 3GPP and 3GPP have standardized (or are standardizing) a few IMS services, such as basic video calls or conferencing, from now on OMA will focus on service standardization for the IMS (of course, other standard bodies and third parties besides OMA may also develop services for the IMS).

2.2 Internet Engineering Task Force (IETF)

The Internet Engineering Task Force (IETF) is a loosely self-organized collection of network designers, operators, vendors, and research institutions that work together to develop the architecture, protocols, and operation of the public Internet. The IETF is body that is open to any interested individual. The IETF is not a corporation and, therefore, does not have a board of directors, members, nor dues.

The IETF is the standardization body that has developed most of the protocols that are currently used on the Internet. The IETF does not standardize networks, architectures combining different protocols, the internal behaviour of nodes, nor APIs (Application Programming Interface). The IETF is the protocol factory for IP-related protocols.

2.2.1 Structure of IETF

Work in the IETF is organized in working groups. Each working group is chartered to perform specific tasks, such as the delivery of a precise set of documents. Each working group has from one to three chairs, who take care that the working group completes its chartered tasks in time. Working groups have a temporary lifetime; so, once they have delivered their documents, either they are rechartered or they cease to exist. Figure 2.1 shows a few, but not all, of the working groups in the IETF; there are more than 100 active working groups in the IETF. The complete up-to-date list of active working groups is available at:

`http://www.ietf.org/html.charters/wg-dir.html`

Working groups get an acronym name that identifies the chartered task. For instance, SIPPING is the acronym of "Session Initiation Protocol Investigation", SIMPLE is the acronym of "SIP for Instant Messaging and Presence Leveraging Extensions" or AAA for "Authentication, Authorization and Accounting".

A collection of working groups form an Area Directorate. There are currently eight areas, as illustrated in Figure 2.1.

Each area has one or two area directors who, together with the IETF chairman, form the IESG (Internet Engineering Steering Group). The IESG is the technical

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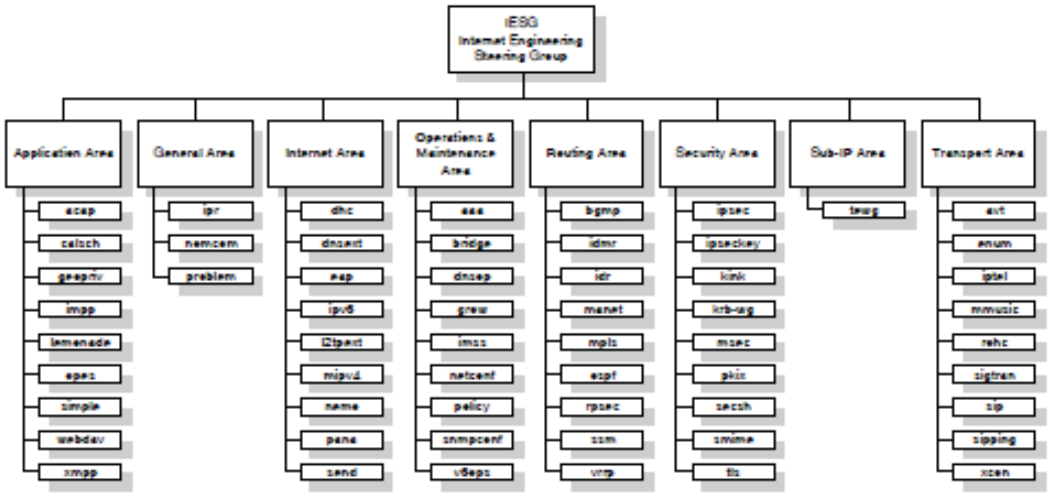


Figure 2.1: The structure of the IETF

management team of the IETF. They decide on which areas the IETF should work and review all the specifications that are produced.

The following web pages contain the complete list of the working groups of all areas and the charter of the SIPPING working group respectively.

`http://www.ietf.org/html.charters/wg-dir.html`
`http://www.ietf.org/html.charters/sipping-charter.html`

The IAB (Internet Architecture Board) is the body that provides technical leadership and handles appeals. Its web page is:

`http://www.iab.org/`

2.2.2 Working Group Operations

The technical work in the IETF is done within the working groups. Working groups do not have any kind of membership; they are formed by a number of volunteers that work as individuals. That is, they do not represent their companies when working for the IETF.

Most of the technical discussions within a working group take place in its mailing list. Even the decisions made at face-to-face meetings (held three times a year) have to be confirmed in the mailing list.

The technical documents used within the working groups are called Internet-Drafts. There are two types of them: individual submissions and working group items. Individual submissions are technical proposals submitted by an individual or individuals. If the working group decides that an individual submission is a good starting point to work on a particular topic, it becomes a working group item.

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Individual submissions and working group items can be distinguished by the name of the file where they are stored. Individual submissions start with:

```
draft-author's_name
```

while working group items start with:

```
draft-ietf-name_of_the_working_group
```

A list of all the Internet-Drafts can be found at:

```
http://www.ietf.org/internet-drafts/
```

When a working group feels that a working group item is ready for publication as an RFC the working group chairs send it to the IESG. The IESG may provide feedback to the working group (e.g., ask that working group to change something in the draft) and, eventually, decides whether or not a new RFC is published.

Although most of the Internet-Drafts that the IESG receives come from working groups an individual may also submit an Internet-Draft to the IESG. This usually happens with topics that are not large enough to grant the creation of a working group, but which, nevertheless, are of interest to the Internet community.

It is important to note that Internet-Drafts, even if they are working group items, represent work in progress and should only be referenced as such. Internet-Drafts are temporary documents that expire and cease to exist six months after they are issued. They can change at any time without taking into consideration backward compatibility issues with existing implementations. Only when a particular Internet-Draft becomes an RFC can it be considered a stable specification.

2.2.3 Types of RFCs

The technical documents produced by the IETF are called RFCs (Request For Comments). According to the contents of the document there are three main types of RFCs:

- Standards-track RFCs.
- Non-standards-track RFCs.
- BCP (Best Current Practise) RFCs.

Standards-track RFCs typically define protocols and extensions to protocols. According to the maturity of the protocol there are three levels of standards-track RFCs: proposed standard, draft standard, and Internet standard. Standards-track specifications are supposed to advance from proposed to draft and, finally, to Internet standard as they get more and more mature. An important requirement in this process is that a particular specification is implemented by several people to show that different independently built implementations that follow the same specification can successfully interoperate.

Nevertheless, in practise only a few RFCs reach the draft standard level and even fewer become Internet standards. At present, the specifications of many protocols that are used massively on the Internet are proposed standards.

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There are three types of non-standards-track RFCs: experimental, informational, and historical (which are called *historic* RFCs). Experimental RFCs specify protocols with a very limited use, while informational RFCs provide information for the Internet community about some topic, such as a requirements document or a process. When a standards-track RFC becomes obsolete, it becomes a historic RFC.

BCP RFCs record the best current practise known to the community to perform a particular task. They may deal with protocol issues or with administrative issues.

Figure 2.2 shows the relations between all the RFC types. A list of all the RFCs published so far and their status can be fetched from:

`http://www.ietf.org/iesg/1rfc_index.txt`

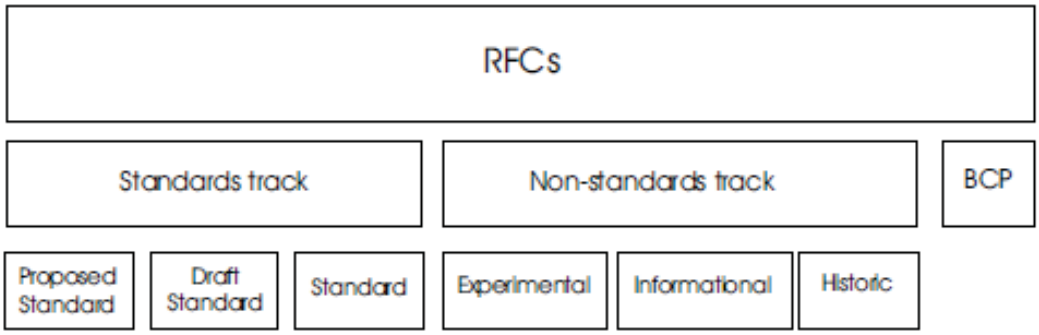


Figure 2.2: RFC types

RFCs can be downloaded from the following web page by just introducing the RFC number:

`http://www.ietf.org/rfc.html`

Additionally, the RFC Editor offers a web page that allows us to search for RFCs by title, number, author and keywords:

`http://www.rfc-editor.org/rfcsearch.html`

2.3 Third Generation Partnership Project (3GPP)

The Third Generation Partnership Project (3GPP) was born in 1998 as a collaboration agreement between a number of regional telecommunication standard bodies, known as *organizational partners*. The current 3GPP organizational partners are:

1. ARIB (Association of Radio Industries and Business) in Japan,

   `http://www.arib.or.jp/english/`

2. CCSA (China Communications Standards Associations) in China,

   `http://www.ccsa.org.cn/english/`

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3. ETSI (European Telecommunications Standards Institute) in Europe,

   `http://www.etsi.org/`

4. Committee T1 in the United States of America,

   `http://www.t1.org/`

5. TTA (Telecommunications Technology Association) of Korea

   `http://www.tta.or.kr/English/`

6. TTC (Telecommunication Technology Committee) in Japan,

   `http://www.ttc.or.jp/e/`

3GPP was originally chartered to develop globally applicable Technical Specifications and Technical Reports for a third-generation mobile system based on GSM. The scope has been reinforced to include maintenance and development of GSM specifications including the supported and evolved radio networks, technologies, and packet access technologies.

Besides the organizational partners, *market representation partners* provide the partnership with market requirements. Market representation partners include, among others, the UMTS Forum, 3G Americas, the GSM Association, the Global mobile Suppliers Association, the TD-SCDMA Forum, and the IPv6 Forum.

3GPP maintains an up-to-date web site at:

`http://www.3gpp.org/`

2.3.1 3GPP Structure

3GPP is organized in a Project Co-ordination Group (PCG) and Technical Specification Groups (TSGs), as illustrated in Figure 2.3. The PCG is responsible for the overall management of 3GPP, time plans, allocation of work, etc. The technical work is produced in the TSGs. At the moment there are five TSGs, responsible for the Core Network (CN), System and Services Aspects (SA), GSM EDGE Radio Access Network (GERAN), Radio Access Network (RAN), and Terminals (T). Each of the TSGs is further divided into Working Groups. Each of the Working Groups is allocated particular tasks. For instance, CN WG1 is responsible for all the detailed design of the usage of SIP and SDP in the IMS, CN WG3 for interworking aspects and CN4 for all the detailed design of the usage of Diameter. SA WG1 is responsible for the requirements, SA2 for the architecture, SA WG3 for the security aspects, SA WG4 for the codecs, and SA WG5 for the operation and maintenance of the network.

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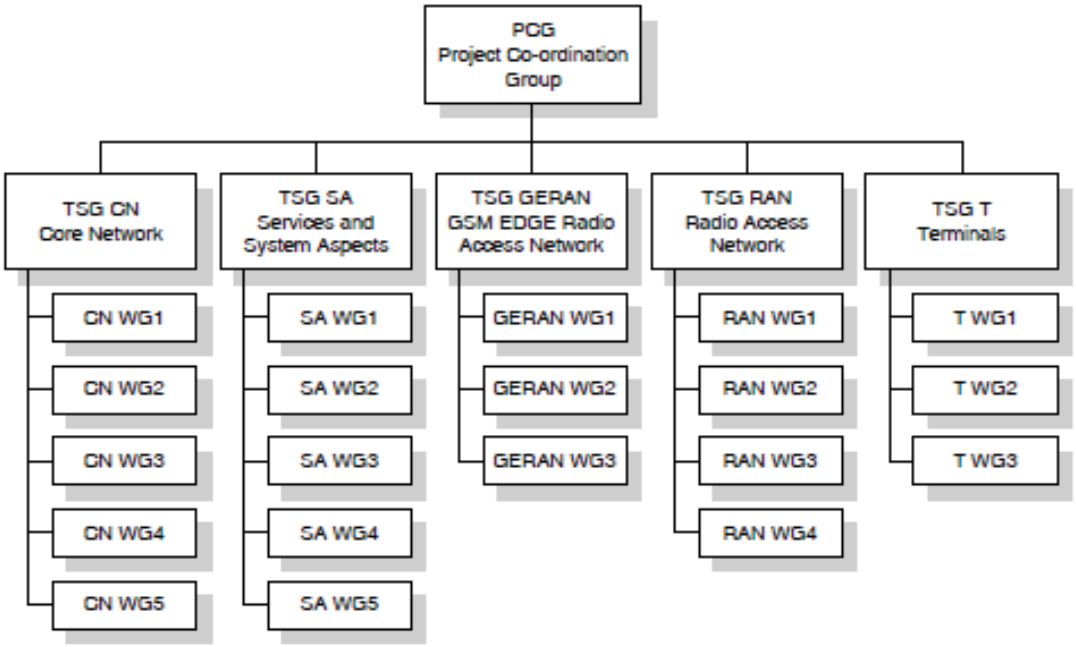


Figure 2.3: The structure of 3GPP

2.3.2 3GPP Deliverables

3GPP working groups do not produce standards. Instead, they produce Technical Specifications (TS) and Technical Reports (TR) that are approved by the TSGs. Once approved they are submitted to the organizational partners to be submitted to their respective standardization processes. The final part of the process is in the organizational partners' hands when they approve the TSs or TRs as part of their standards procedures. As a result, there is a set of globally developed standards that are ready to be used in a particular region.

3GPP TSs and TRs are numbered according to the sequence of four or five digits that follow the pattern "xx.yyy". The first two digits "xx" identify the series number, and the last two or three digits "yy" or "yyy" identify a particular specification within a series. For instance, 3GPP TS 23.228 [21] describes the architectural aspects of the IMS.

3GPP groups its specifications in what is called a *Release*. 3GPP Release 5 contains the first version of the IMS. 3GPP Release 6 contains enhancements to the IMS. The reader must note that the IMS is just a fraction of the 3GPP deliverables in a particular Release, as there are other non-IMS specifications included in a 3GPP Release. 3GPP TSs and TRs include a version number that follows the pattern "x.y.z", where "x" represents the 3GPP Release where the specification is published, "y" is the version number, and "z" is a sub-version number. So, 3GPP TS 23.228 version 5.8.0 means version 8.0 of the Release 5 version of TS 23.228.

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3GPP TSs and TRs are publicly available at the 3GPP web site at either of the following URIs:

`http://www.3gpp.org/specs/specs.htm`

`http://www.3gpp.org/ftp/Specs/archive/`

2.4 Third Generation Partnership Project 2 (3GPP2)

If 3GPP was born to evolve GSM specifications into a third-generation cellular system, the Third Generation Partnership Project 2 (3GPP2) was born to evolve North American and Asian cellular networks based on ANSI/TIA/EIA-41 standards and CDMA2000© radio access into a third-generation system. 3GPP2 like 3GPP is a partnership project whose members are also known as *organizational partners*. The current list of organizational partners include ARIB (Japan), CCSA (China), TIA (Telecommunications Industry Association) (North America), TTA (Korea), and TTC (Japan). Probably, the reader has noticed that most of them are also organizational partners of 3GPP.

Like 3GPP, 3GPP2 gets market requirements and advice from *market representation partners*. At the moment the list includes the IPv6 Forum and the CDMA Development Group.

2.4.1 3GPP2 Structure

The 3GPP2 structure mimics the structure of 3GPP, as illustrated in Figure 2.4. A Steering Committee (SC) is responsible for the overall standardization process and the planning. The technical work is done in Technical Specification Groups (TSGs). TSG-A is focused on the Access Network Interface, TSG-C on CDMA2000© technology, TSG-S on Service and System Aspects, and TSG-X in Intersystems Operations. TGS-X was born as a merger between the former TSG-N (Core Networks) and TSG-P (Packet Data) TSGs. The structure of TSN-X is not completely defined yet.

2.4.2 3GPP2 Deliverables

Like 3GPP, 3GPP2 does not produce standards but, instead, Technical Specifications (TSs) and Technical reports (TRs). The documents are created by the TSGs and approved by the SC. Then, they are submitted to the organizational partners to be submitted to their respective standardization processes.

3GPP2 TSs and TRs are numbered with a sequence of letters and digits that follows the scheme "A.Bxxxx-yyy-R" where "A" is a letter that represents the name of the TSG that delivers the document, "B" can be an "R" letter to indicate a TR or a requirements document, but it can also be an "S" letter to indicate a TS. "xxxx" is a sequential number allocated to the document. An optional "yyy" sequence of digits can further identify the chapter within a specification series. The "R" letter identifies the revision. The version number follows the specification and indicates a major and

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APPENDIX 9

3GPP MEMBERSHIP

2024-02-19 Version 1.1

New Query

Selected categories:

- **Individual Members (all partners)**

Choose csv separator : , export to csv file

INDIVIDUAL MEMBERS

Organization	Country	Partner
3in **(Industrial Internet Innovation Center (Shanghai) Co.,Ltd.)**	CHINA	CCSA
450connect GmbH **(450connect GmbH)**	GERMANY	ETSI
A.S.T.R.I.D. SA/NV **(A.S.T.R.I.D. SA)**	BELGIUM	ETSI
ABP, NRTA **(Academy of Broadcasting Planning, NRTA)**	CHINA	CCSA
ABS **(Academy of Broadcasting Science)**	CHINA	CCSA
AccelerComm Ltd **(AccelerComm Ltd)**	UNITED KINGDOM	ETSI
Acer Incorporated **(Acer Incorporated)**	TAIWAN, PROVINCE OF CHINA	ETSI
adare GmbH **(adare GmbH)**	GERMANY	ETSI
Airbus **(Airbus DS SLC)**	FRANCE	ETSI
albis-elcon system GermanyGmbH **(albis-elcon system Germany GmbH)**	GERMANY	ETSI
Alibaba (China) Group., Ltd. **(Alibaba (China) Group., Ltd.)**	CHINA	CCSA
Allot Ltd **(Allot Ltd)**	ISRAEL	ETSI
Altan Redes S.A.P.I. de C.V. **(Altan Redes S.A.P.I. de C.V.)**	MEXICO	ETSI
Amazon Web Services **(Amazon Web Services EMEA SARL)**	LUXEMBOURG	ETSI
Amdocs Software Systems Ltd **(Amdocs Software Systems Limited)**	IRELAND	ETSI
Analog Devices, Inc. **(Analog Devices, Inc.)**	UNITED STATES	ATIS
Anemone Technology **(Anemone Technology)**	DENMARK	ETSI
Anritsu Corporation **(ANRITSU CORPORATION)**	JAPAN	ARIB
Anritsu EMEA Ltd **(Anritsu EMEA Ltd)**	UNITED KINGDOM	ETSI
Anterix **(Anterix)**	UNITED STATES	ATIS
Apple **(Apple Purchase Operation management)**	CHINA	CCSA
Apple (Guizhou) **(Apple Technology Services (Guizhou) Ltd.)**	CHINA	CCSA

Apple (UK) Limited **(Apple (UK) Limited)**	UNITED KINGDOM	ETSI
Apple (Ulanqab) **(Apple Technology Services (Ulanqab) Ltd)**	CHINA	CCSA
Apple AB Denmark **(Apple AB, filial AF Apple Aktiebolag, Sverige)**	DENMARK	ETSI
Apple Benelux B.V. **(Apple Benelux B.V.)**	NETHERLANDS	ETSI
Apple Benelux B.V. - Belgium **(Apple Benelux B.V. - Belgium Branch)**	BELGIUM	ETSI
Apple Computer Trading Co. Ltd **(Apple Computer Trading (Shanghai) Co., Ltd.)**	CHINA	CCSA
Apple Distribution Intl Ltd **(Apple Distribution International Limited)**	IRELAND	ETSI
Apple France **(Apple France)**	FRANCE	ETSI
Apple GmbH **(Apple GmbH)**	GERMANY	ETSI
Apple Inc **(Apple Inc)**	UNITED STATES	ATIS
Apple R&D **(Apple R&D)**	CHINA	CCSA
Apple Solutions **(Apple Solutions Consulting Services (Beijing) Company Limited)**	CHINA	CCSA
Apple Switzerland AG **(Apple Switzerland AG)**	SWITZERLAND	ETSI
Apple Trading **(Apple Trading (Shanghai) Company Limited)**	CHINA	CCSA
AQSACOM S.A.S. **(AQSACOM S.A.S.)**	FRANCE	ETSI
Arriver Software AB **(Arriver Software AB)**	SWEDEN	ETSI
ARTICLE19 **(ARTICLE19)**	UNITED KINGDOM	ETSI
ASELSAN **(ASELSAN Inc.)**	TÜRKIYE	ETSI
AsiaInfo **(AsiaInfo Technologies (China), Inc.)**	CHINA	CCSA
AsiaInfo Technologies Inc **(AsiaInfo Technologies Inc)**	CHINA	ETSI
ASR **(ASR Microelectronics Co., Ltd.)**	CHINA	CCSA
ASTRI **(Hong Kong Applied Science & Technology Research Institute)**	HONG KONG	ETSI
Astrome Technologies Pvt Lt **(Astrome Technologies Pvt Lt)**	INDIA	TSDSI
ASUSTEK COMPUTER (SHANGHAI) **(ASUSTEK COMPUTER (SHANGHAI) CO. LTD.)**	CHINA	CCSA
AT&T **(AT&T)**	UNITED STATES	ATIS
AT&T GNS Belgium SPRL **(AT&T Global Network Services Belgium SPRL)**	BELGIUM	ETSI
AT&T Labs, Inc **(AT&T Labs, Inc)**	UNITED STATES	ATIS
AT&T Services, Inc. **(AT&T Services, Inc.)**	UNITED STATES	ATIS
ATEME **(ATEME SA)**	FRANCE	ETSI
Avanti **(Avanti Communications Ltd)**	UNITED KINGDOM	ETSI
BAE Systems AI Ltd **(BAE Systems Applied Intelligence Limited)**	UNITED KINGDOM	ETSI
Baicells Technologies Co. Ltd **(Baicells Technologies Co. Ltd)**	CHINA	CCSA
BBC	UNITED KINGDOM	ETSI

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(BRITISH BROADCASTING CORPORATION)		
B-Com **(B-Com)**	FRANCE	ETSI
BDBOS **(Federal Agency for Public Safety Digital Radio)**	GERMANY	ETSI
BeammWave AB **(BeammWave AB)**	SWEDEN	ETSI
Beijing Lenovo Software Ltd. **(Beijing Lenovo Software Ltd.)**	CHINA	CCSA
BEIJING SAMSUNG TELECOM R&D **(BEIJING SAMSUNG TELECOM R&D CENTER)**	CHINA	CCSA
Beijing Xiaomi Electronics **(Beijing Xiaomi Electronics)**	CHINA	CCSA
Beijing Xiaomi Mobile Software **(Beijing Xiaomi Mobile Software Co., Ltd)**	CHINA	CCSA
Beijing Xiaomi Mobile Software **(Beijing Xiaomi Mobile Software Co., Ltd.)**	CHINA	ETSI
Beijing Xiaomi Software Tech **(Beijing Xiaomi Software Technology)**	CHINA	CCSA
Bell Mobility **(Bell Mobility)**	CANADA	ETSI
BfV **(Bundesamt für Verfassungsschutz)**	GERMANY	ETSI
Bharti Airtel Limited **(Bharti Airtel Limited)**	INDIA	TSDSI
BIFNC **(BRICS Institute of Future Network)**	CHINA	CCSA
BIPT **(BIPT - Belgian Institute for Postal services & Telecommunications)**	BELGIUM	ETSI
Bittium Wireless Ltd. **(Bittium Wireless Ltd.)**	FINLAND	ETSI
BJTU **(Beijing Jiaotong University)**	CHINA	CCSA
BKA **(Bundeskriminalamt)**	GERMANY	ETSI
Bluetest AB **(Bluetest AB)**	SWEDEN	ETSI
BMF **(Austrian Federal Ministry of Finance)**	AUSTRIA	ETSI
BMWK **(Bundesministerium für Wirtschaft und Klimaschutz)**	GERMANY	ETSI
BOCRA **(Botswana Communications Regulatory Authority)**	BOTSWANA	ETSI
BOUYGUES Telecom **(BOUYGUES Telecom)**	FRANCE	ETSI
Broadcom (EU) **(Broadcom Europe Ltd)**	UNITED KINGDOM	ETSI
BSI (DE) **(Bundesamt für Sicherheit in der Informationstechnik)**	GERMANY	ETSI
BSNL **(Bharat Sanchar Nigam Limited)**	INDIA	TSDSI
BT plc **(British Telecommunications plc)**	UNITED KINGDOM	ETSI
BTL Inc. **(BTL Inc.)**	CHINA	ETSI
BTPDI **(Beijing Telecom Planning & Designing Institute Co.,LTD.)**	CHINA	CCSA
BUPT **(Beijing University of Posts and Telecommunications)**	CHINA	CCSA
Bureau Veritas ADT **(Bureau Veritas Consumer Products Services (Hong Kong) Limited, Taoyuan Branch)**	TAIWAN, PROVINCE OF CHINA	ETSI
Bytedance **(Bytedance (Nanjing) Technology Research and Development Co., Ltd.)**	CHINA	CCSA
C Spire Wireless **(C Spire Wireless)**	UNITED STATES	ATIS

CableLabs **(CableLabs)**	UNITED STATES	ETSI
Cadence Design Systems Inc. **(Cadence Design Systems Inc.)**	UNITED STATES	ETSI
CAICT. **(China Academy of Information and Communications Technology)**	CHINA	CCSA
CALTTA **(CALTTA TECHNOLOGIES CO., LTD.)**	CHINA	CCSA
Cambium Networks Limited **(Cambium Networks Limited)**	UNITED KINGDOM	ETSI
CAMBRIDGE CONSULTANTS LTD **(CAMBRIDGE CONSULTANTS LTD)**	UNITED KINGDOM	ETSI
CANON Research Centre France **(CANON Research Centre France SAS)**	FRANCE	ETSI
Casa Systems Inc. **(Casa Systems Inc.)**	UNITED STATES	ETSI
Catapult **(Satellite Applications Catapult Ltd)**	UNITED KINGDOM	ETSI
CATT **(China Academy of Telecommunications Technology (CATT))**	CHINA	ETSI
CATT **(China Academy of Telecommunication Technology - (Datang Telecom Technology and Industry Group))**	CHINA	CCSA
CBN **(China Broadcasting Network Group Corporation Ltd.)**	CHINA	CCSA
CCU **(National Chung Cheng University)**	TAIWAN, PROVINCE OF CHINA	ETSI
C-DAC **(Centre for Development of Advanced Computing)**	INDIA	TSDSI
C-DOT **(C-DOT)**	INDIA	TSDSI
CEA **(Commissariat à l'Energie Atomique et aux Energies Alternatives)**	FRANCE	ETSI
Cellnex **(Cellnex Telecom)**	SPAIN	ETSI
CENC **(CETC Network & Communications Group Co., Ltd.)**	CHINA	CCSA
CEPRI **(China Electric Power Research Institute)**	CHINA	CCSA
Ceragon Networks AS **(Ceragon Networks AS)**	NORWAY	ETSI
CERTH **(CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS)**	GREECE	ETSI
cetecom advanced GmbH **(cetecom advanced GmbH)**	GERMANY	ETSI
CEWiT **(Centre of Excellence in Wireless Technology (CEWiT))**	INDIA	TSDSI
CGL **(CHAZAH GROUP LTD)**	UGANDA	ETSI
Charter Communications, Inc **(Charter Communications, Inc)**	UNITED STATES	ATIS
Chengdu OPPO Telecommunication **(Chengdu OPPO Mobile Telecommunications Corp., ltd.)**	CHINA	CCSA
CHENGDU TD TECH LTD. **(CHENGDU TD TECH LTD.)**	CHINA	CCSA
China Broadnet **(China Broadnet Mobile Communications Co., Ltd.)**	CHINA	CCSA
China Mobile (Hangzhou) Inf. **(China Mobile (Hangzhou) Information Technology Co., Ltd.)**	CHINA	CCSA
China Mobile (Suzhou) Software **(China Mobile (Suzhou) Software Technology Co., Ltd.)**	CHINA	CCSA
China Mobile Com. Corporation **(China Mobile Communications Corporation (CMCC))**	CHINA	CCSA
China Mobile E-Commerce Co. **(China Mobile E-Commerce Co.)**	CHINA	CCSA
China Mobile Group Device Co.	CHINA	CCSA

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(China Mobile Group Device Co., Ltd)		
China Mobile International Ltd **(China Mobile International Limited)**	CHINA	CCSA
China Mobile M2M Company Ltd. **(China Mobile M2M Company Ltd.)**	CHINA	CCSA
China Southern Power Grid Co. **(China Southern Power Grid Co., Ltd.)**	CHINA	CCSA
China Telecom Corporation Ltd. **(China Telecom Corporation Ltd.)**	CHINA	CCSA
China Telecommunications **(China Telecommunications Corporation)**	CHINA	ETSI
China Telecomunication Corp. **(China Telecomunication Corporation)**	CHINA	CCSA
China Unicom **(China Unicom)**	CHINA	CCSA
Chinatelecom Cloud **(China Telecom Cloud Technology Co., Ltd)**	CHINA	CCSA
Chongqing University **(Chongqing University)**	CHINA	CCSA
Chosun University **(Chosun University)**	KOREA (REPUBLIC OF)	TTA
CHTTL **(Chunghwa Telecommunication Laboratories, Chunghwa Telecommunication Co.)**	TAIWAN, PROVINCE OF CHINA	ETSI
CICT **(China Information Communication Technologies Group)**	CHINA	ETSI
CICT **(China Information Communication Technologies Group Corporation)**	CHINA	CCSA
CICT Mobile **(CICT Mobile Communication Technology Co., Ltd.)**	CHINA	CCSA
CICTCI **(CICT Connected and Intelligent Technologies Co., Ltd)**	CHINA	CCSA
CIS **(Center for Internet Security)**	UNITED STATES	ETSI
CISA ECD **(Cybersecurity and Infrastructure Security Agency (CISA) ECD)**	UNITED STATES	ATIS
Cisco Systems **(Cisco Systems)**	UNITED STATES	ATIS
Cisco Systems Belgium **(Cisco Systems Belgium)**	BELGIUM	ETSI
Cisco Systems France **(Cisco Systems France)**	FRANCE	ETSI
CITC **(CHINA INFORMATION TECHNOLOGY DESIGNING&CONSULTING INSTITUTE CO.,LTD.)**	CHINA	CCSA
CKH IOD UK LIMITED **(CKH IOD UK LIMITED)**	UNITED KINGDOM	ETSI
CMDI **(China Mobile Group Design Institute Co., Ltd)**	CHINA	CCSA
CNC **(CLAP-N-CLANK)**	JAPAN	ETSI
CNES **(CNES - Centre National d'Etudes Spatiales)**	FRANCE	ETSI
Cobham SatCom A/S **(Thrane & Thrane A/S)**	DENMARK	ETSI
Cognyte **(Cognyte Technologies Israel Ltd.)**	ISRAEL	ETSI
Cohere Technologies **(Cohere Technologies)**	UNITED STATES	ATIS
Comba **(Comba Network Systems Company Limited)**	CHINA	CCSA
Comcast **(Comcast)**	UNITED STATES	ATIS
Comprion GmbH **(Comprion GmbH)**	GERMANY	ETSI
Comtech Telecommunications Cor **(Comtech Telecommunications Corp)**	UNITED STATES	ATIS

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Consort Digital **(Consort Digital Private Limited)**	INDIA	ETSI
Continental Automotive **(Continental Automotive Technologies GmbH)**	GERMANY	ETSI
Convida Wireless **(Convida Wireless, LLC)**	UNITED STATES	ETSI
Cosmian **(Cosmian Tech SAS)**	FRANCE	ETSI
COSMOTE S.A. **(COSMOTE MOBILE TELECOMMUNICATIONS S.A.)**	GREECE	ETSI
CQUPT **(Chongqing University of Posts and Telecommunications)**	CHINA	CCSA
Crosscall **(Crosscall)**	FRANCE	ETSI
CSA **(Cyber Security Agency of Singapore)**	SINGAPORE	ETSI
CSCN **(CHINA SATELLITE NETWORK GROUP CO., LTD.)**	CHINA	CCSA
CSIRO **(Commonwealth Scientific and Industrial Research Organisation)**	AUSTRALIA	ETSI
cstconsultancy **(CyberSecurity & Technology Consultancy LTD)**	UNITED KINGDOM	ETSI
CTSI **(China Telecom System Integration Co., Ltd)**	CHINA	CCSA
CTTC **(Centre tecnologic de Telecomunicacions de Catalunya)**	SPAIN	ETSI
CU Digital Technology **(China Unicom Digital Technology Co., Ltd.)**	CHINA	CCSA
CUC **(Communication University of China)**	CHINA	CCSA
CUG **(China Unicom Global Limited)**	CHINA	CCSA
Cybercore **(Beijinig Cybercore Technology Co., Ltd.)**	CHINA	CCSA
Cygnusemi **(Cygnusemi)**	CHINA	CCSA
Czech Telecommunication Office **(Czech Telecommunication Office)**	CZECH REPUBLIC	ETSI
DAC-UPC **(Departamento de Arquitectura de Computadores de la Universidad Politecnica de Cataluna (DAC-UPC))**	SPAIN	ETSI
DanKook University **(DanKook University)**	KOREA (REPUBLIC OF)	TTA
DARS TELECOM S.L. **(DARS TELECOM S.L.)**	SPAIN	ETSI
Datang Linktester Technology **(Datang Linktester Technology Co., Ltd.)**	CHINA	CCSA
Datang Mobile Com. Equipment **(Datang Mobile Communications Equipment Co., Ltd)**	CHINA	CCSA
DEKRA **(DEKRA testing and Certification, S.A.U.)**	SPAIN	ETSI
Dell Technologies **(Dell Technologies)**	UNITED STATES	ATIS
DENSO CORPORATION **(DENSO CORPORATION)**	JAPAN	ARIB
Department of Telecom **(Department of Telecommunications)**	INDIA	TSDSI
Dept of Home Affairs **(Department of Home Affairs)**	AUSTRALIA	ETSI
Deutsche Telekom AG **(Deutsche Telekom AG)**	GERMANY	ETSI
DIGG **(Agency for Digital Government)**	SWEDEN	ETSI
DISA **(Defense Information Systems Agency)**	UNITED STATES	ATIS
Dish Network	UNITED STATES	ATIS

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(Dish Network)		
DLR **(Deutsches Zentrum für Luft- und Raumfahrt e.V.)**	GERMANY	ETSI
DOCOMO Beijing Labs **(DOCOMO Beijing Communications Laboratories Co., Ltd)**	CHINA	CCSA
DOCOMO Communications Lab. **(DOCOMO Communications Laboratories Europe GmbH)**	GERMANY	ETSI
Dolby France SAS **(Dolby France SAS)**	FRANCE	ETSI
Dolby Germany GmbH **(Dolby Germany GmbH)**	GERMANY	ETSI
Dolby Sweden AB **(Dolby Sweden AB)**	SWEDEN	ETSI
Douyin **(Beijing Douyin Information Service Co., Ltd.)**	CHINA	CCSA
DP **(DigitalPlatforms SpA)**	ITALY	ETSI
DSIT **(Department for Science, Innovation and Technology)**	UNITED KINGDOM	ETSI
DTCY **(Deloitte Tohmatsu Cyber LLC)**	JAPAN	TTC
DTS Licensing Limited **(DTS Licensing Limited)**	IRELAND	ETSI
EBU **(EBU - European Broadcasting Union)**	SWITZERLAND	ETSI
ECTL **(Enhanced Communications & Technologies Pvt Ltd)**	INDIA	TSDSI
EDF Recherche et Développement **(EDF)**	FRANCE	ETSI
EFORT **(Etudes et Formations en Telecommunication)**	FRANCE	ETSI
Elbit Systems **(Elbit Systems C4I and Cyber Ltd)**	ISRAEL	ETSI
Element Materials Technology **(Element Materials Technology Warwick Ltd)**	UNITED KINGDOM	ETSI
Elena **(Elena Geo Systems Pvt Ltd)**	INDIA	TSDSI
Embotech AG **(Embotech AG)**	SWITZERLAND	ETSI
EMITE **(EMITE Ingenieria S.L.)**	SPAIN	ETSI
ENENSYS **(ENENSYS Technologies SA)**	FRANCE	ETSI
Ericsson España S.A. **(Ericsson España S.A.)**	SPAIN	ETSI
Ericsson France S.A.S **(Ericsson France S.A.S)**	FRANCE	ETSI
Ericsson GmbH, Eurolab **(Ericsson GmbH, Eurolab - Unternehmensbereich Forschung und Entwicklung)**	GERMANY	ETSI
Ericsson Hungary Ltd **(Ericsson Hungary Ltd)**	HUNGARY	ETSI
Ericsson Inc. **(Ericsson Incorporated)**	UNITED STATES	ATIS
Ericsson India Private Limited **(Ericsson India Private Limited)**	INDIA	TSDSI
Ericsson Japan K.K. **(Ericsson Japan K.K.)**	JAPAN	ARIB
Ericsson Limited **(Ericsson Limited)**	UNITED KINGDOM	ETSI
Ericsson LM **(Ericsson Telefonaktiebolaget LM)**	SWEDEN	ETSI
Ericsson Telecomunicazioni SpA **(Ericsson Telecomunicazioni SpA)**	ITALY	ETSI
Ericsson-LG Co., LTD **(Ericsson-LG Co., LTD)**	KOREA (REPUBLIC OF)	TTA

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Erillisverkot **(Suomen Erillisverkot Oy)**	FINLAND	ETSI
ERNET India **(ERNET India)**	INDIA	TSDSI
ESA **(ESA - European Space Agency)**	NETHERLANDS	ETSI
E-SPACE **(E-SPACE SAS)**	FRANCE	ETSI
ESSEN INNOVATION **(ESSEN INNOVATION COMPANY LIMITED)**	CHINA	CCSA
E-surfing Digital **(E-surfing Digital Life Technology Co., Ltd)**	CHINA	CCSA
Esurfing IoT **(Esurfing IoT Tech Co., Ltd)**	CHINA	CCSA
ETELM **(Electronique Telematique ETELM)**	FRANCE	ETSI
Etherstack Wireless Limited **(Etherstack Wireless Limited)**	UNITED KINGDOM	ETSI
ETRI **(Electronics & Telecommunications Research Institute)**	KOREA (REPUBLIC OF)	TTA
ETS-Lindgren Europe **(ETS-Lindgren Europe)**	FINLAND	ETSI
EURECOM **(EURECOM)**	FRANCE	ETSI
Eurofins KCTL **(Eurofins KCTL Co. Ltd)**	KOREA (REPUBLIC OF)	ETSI
European Commission **(EC - European Commission)**	BELGIUM	ETSI
European Patent Organisation **(European Patent Organisation)**	GERMANY	ETSI
EUTC **(European Utilities Telecom Council (EUTC))**	BELGIUM	ETSI
Eutelsat Group **(Eutelsat S.A.)**	FRANCE	ETSI
EVE Compliancy Solutions **(EVE Compliancy Solutions)**	NETHERLANDS	ETSI
Everactive **(Everactive)**	UNITED STATES	ATIS
F5 **(F5, Inc.)**	UNITED STATES	ETSI
Fabasoft AG **(Fabasoft AG)**	AUSTRIA	ETSI
Facebook Japan G.K. **(Facebook Japan G.K.)**	JAPAN	ARIB
Fastweb S.p.A. **(Fastweb S.p.A.)**	ITALY	ETSI
FAU **(Friedrich-Alexander-Universität Erlangen-Nürnberg)**	GERMANY	ETSI
FBK **(Fondazione Bruno Kessler)**	ITALY	ETSI
FCC **(Federal Communications Commission)**	UNITED STATES	ATIS
Fiberhome Technologies Group **(Fiberhome Technologies Group)**	CHINA	CCSA
FirstNet **(FirstNet)**	UNITED STATES	ATIS
FORCE Technology **(FORCE Technology)**	DENMARK	ETSI
Ford **(Ford Motor Company)**	UNITED STATES	ETSI
Fraunhofer FOKUS **(Fraunhofer Institute for Open Communication Systems FOKUS)**	GERMANY	ETSI
Fraunhofer HHI **(Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute)**	GERMANY	ETSI
Fraunhofer IIS	GERMANY	ETSI

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(Fraunhofer Institut für Integrierte Schaltungen IIS)		
Frequentis AG **(Frequentis AG)**	AUSTRIA	ETSI
Fujitsu Limited **(Fujitsu Limited)**	JAPAN	ETSI
Fujitsu Limited. **(Fujitsu Limited.)**	JAPAN	TTC
Fujitsu Limited.. **(Fujitsu Limited..)**	JAPAN	ARIB
Futurewei **(Futurewei Technologies Inc.)**	UNITED STATES	ETSI
Futurewei Technologies **(Futurewei Technologies)**	UNITED STATES	ATIS
G+D MS **(Giesecke+Devrient Mobile Security Germany GmbH)**	GERMANY	ETSI
Gatehouse Satcom A/S **(Gatehouse Satcom A/S)**	DENMARK	ETSI
GDCNI **(Guangdong Communications and Networks Institute)**	CHINA	CCSA
GE Network Technologies, LLC **(GE Network Technologies, LLC)**	UNITED STATES	ATIS
GEESPACE **(ZHE JIANG GEESPACE TECHNOLOGY CO., LTD.)**	CHINA	CCSA
Gigaset Communications GmbH **(Gigaset Communications GmbH)**	GERMANY	ETSI
Gilat **(Gilat Satellite Networks Ltd)**	ISRAEL	ETSI
GLOBALSTAR Inc. **(GLOBALSTAR Inc.)**	UNITED STATES	ETSI
GM - ATCI **(General Motors - ATCI)**	ISRAEL	ETSI
Google Inc. **(Google Inc.)**	UNITED STATES	ATIS
Group 2000 **(Group 2000 Nederland B.V.)**	NETHERLANDS	ETSI
GTRC **(Georgia Tech Research Corporation)**	UNITED STATES	ETSI
GUANGDONG GENIUS TECHNOLOGY CO **(GUANGDONG GENIUS TECHNOLOGY CO., LTD.)**	CHINA	CCSA
Guangdong OPPO Mobile Telecom. **(Guangdong OPPO Mobile Telecommunications Corp., Ltd)**	CHINA	CCSA
GW **(Greenerwave)**	FRANCE	ETSI
HA/ST **(HARTING Stiftung & Co. KG)**	GERMANY	ETSI
Hangzhou Douku **(Hangzhou Douku Software Technologies Co., Ltd.)**	CHINA	CCSA
Hangzhou Mengyuxiang **(Hangzhou Mengyuxiang Network Technology Corp., Ltd.)**	CHINA	CCSA
Harman GmbH **(Harman Becker Automotive Systems GmbH)**	GERMANY	ETSI
HEAD acoustics GmbH **(HEAD acoustics GmbH)**	GERMANY	ETSI
Hewlett-Packard Enterprise **(Hewlett-Packard Enterprise)**	FRANCE	ETSI
HiSilicon Technologies Co. Ltd **(HiSilicon Technologies Co.Ltd)**	CHINA	CCSA
HISPASAT SA **(HISPASAT SA)**	SPAIN	ETSI
HOME OFFICE **(HOME OFFICE)**	UNITED KINGDOM	ETSI
Honda Motor Co., Ltd **(Honda Motor Co., Ltd)**	JAPAN	ARIB
Honor **(Honor Device Co., Ltd)**	CHINA	ETSI

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Honor **(Honor Device Co., Ltd.)**	CHINA	CCSA
Huawei Device Co., Ltd **(Huawei Device Co., Ltd)**	CHINA	CCSA
HUAWEI TECH. GmbH **(HUAWEI TECHNOLOGIES Duesseldorf GmbH)**	GERMANY	ETSI
Huawei Tech.(UK) Co.. Ltd **(Huawei Technologies (UK) Co., Ltd.)**	UNITED KINGDOM	ETSI
Huawei Technologies (Korea) **(Huawei Technologies (Korea))**	KOREA (REPUBLIC OF)	TTA
HUAWEI TECHNOLOGIES Co. Ltd. **(Huawei Technologies Co. Ltd.)**	CHINA	ETSI
HuaWei Technologies Co., Ltd **(HuaWei Technologies Co., Ltd)**	CHINA	CCSA
Huawei Technologies France **(Huawei Technologies France)**	FRANCE	ETSI
Huawei Technologies Japan K.K. **(Huawei Technologies Japan K.K.)**	JAPAN	TTC
HUAWEI Technologies Japan K.K. **(HUAWEI Technologies Japan K.K.)**	JAPAN	ARIB
Huawei Technologies R&D UK **(Huawei Technologies Research & Development (UK) Limited)**	UNITED KINGDOM	ETSI
Huawei Technologies Sweden AB **(Huawei Technologies Sweden AB)**	SWEDEN	ETSI
Huawei Telecommunication India **(Huawei Telecommunication (India) Co. Pvt. Ltd.)**	INDIA	TSDSI
HUGHES Network Systems Ltd **(HUGHES Network Systems Ltd)**	UNITED KINGDOM	ETSI
Husqvarna AB **(Husqvarna AB (publ))**	SWEDEN	ETSI
Hytera Communications Corp. **(Hytera Communications Corporation Limited)**	CHINA	CCSA
Hyundai Motor Company **(Hyundai Motor Company)**	KOREA (REPUBLIC OF)	TTA
IBM Europe **(IBM Europe)**	GERMANY	ETSI
ICS **(Institute for Communication Systems - University of Surrey)**	UNITED KINGDOM	ETSI
IDEMIA **(IDEMIA)**	FRANCE	ETSI
IDRBT **(Institute for Development and Research in Banking Technology)**	INDIA	TSDSI
III **(Institute for Information Industry)**	TAIWAN, PROVINCE OF CHINA	ETSI
IIIT Bangalore **(International Institute of Information Technology - Bangalore)**	INDIA	TSDSI
IIIT Naya Raipur **(International Institute of Information Technology, Naya Raipur)**	INDIA	TSDSI
IISc, Bangalore **(Indian Institute of Science, Bangalor)**	INDIA	TSDSI
IIT Bhilai **(Indian Institute of Technology Bhilai)**	INDIA	TSDSI
IIT Bombay **(Indian Institute of Technology Bombay)**	INDIA	TSDSI
IIT Delhi **(Indian Institute of Technology Delhi)**	INDIA	TSDSI
IIT Gandhinagar **(Indian Institute of Technology Gandhinagar)**	INDIA	TSDSI
IIT JODHPUR **(Indian Institute of Technology Jodhpur)**	INDIA	TSDSI
IIT Kanpur **(Indidan Institute of Technology Kanpur)**	INDIA	TSDSI
IIT Mandi **(Indian Institute of Technology Mandi)**	INDIA	TSDSI
IIT Patna	INDIA	TSDSI

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(Indian Institute of Technology Patna)		
IIT, Kharagpur **(IIT, Kharagpur)**	INDIA	TSDSI
IMDA **(Infocomm Media Development Authority)**	SINGAPORE	ETSI
IMU **(Istanbul Medipol University)**	TÜRKIYE	ETSI
Indian Institute of Tech (H) **(Indian Institute of Technology Hyderabad)**	INDIA	TSDSI
Indian Institute of Tech (M) **(Indian Institute of Technology Madras)**	INDIA	TSDSI
INFINEON TECHNOLOGIES **(Infineon Technologies)**	GERMANY	ETSI
Inmarsat **(Inmarsat)**	UNITED KINGDOM	ETSI
Institut Mines-Telecom **(Institut Mines-Telecom)**	FRANCE	ETSI
Institute VEDECOM **(Institute VEDECOM)**	FRANCE	ETSI
Intel **(Intel)**	UNITED STATES	ATIS
Intel Belgium SA/NV **(Intel Belgium SA/NV)**	BELGIUM	ETSI
Intel China Ltd. **(Intel China Ltd.)**	CHINA	CCSA
Intel Corporation (UK) Ltd **(Intel Corporation (UK) Ltd)**	UNITED KINGDOM	ETSI
Intel Corporation Italia SpA **(Intel Corporation Italia SpA)**	ITALY	ETSI
Intel Corporation SAS **(Intel Corporation SAS)**	FRANCE	ETSI
Intel Deutschland GmbH **(Intel Deutschland GmbH)**	GERMANY	ETSI
Intel Ireland **(Intel Ireland Ltd)**	IRELAND	ETSI
Intel K.K. **(Intel K.K.)**	JAPAN	ARIB
Intel Sweden AB **(Intel Sweden AB)**	SWEDEN	ETSI
Intel Technology India Pvt Ltd **(Intel Technology India Pvt. Ltd.)**	INDIA	TSDSI
Intel Technology Poland SP Zoo **(Intel Technology Poland SP Zoo)**	POLAND	ETSI
Intelsat **(Intelsat)**	UNITED STATES	ATIS
InterDigital Belgium. LLC **(InterDigital Belgium, LLC)**	BELGIUM	ETSI
InterDigital Canada **(InterDigital Canada)**	CANADA	ATIS
InterDigital Communications **(InterDigital Communications Corporation)**	UNITED STATES	ATIS
InterDigital Finland Oy **(InterDigital Finland Oy)**	FINLAND	ETSI
InterDigital France R&D, SAS **(InterDigital France R&D, SAS)**	FRANCE	ETSI
InterDigital New York **(InterDigital New York)**	UNITED STATES	ATIS
InterDigital Pennsylvania **(InterDigital Pennsylvania)**	UNITED STATES	ATIS
InterDigital, Europe, Ltd. **(InterDigital, Europe, Ltd.)**	UNITED KINGDOM	ETSI
InterDigital, Inc. **(InterDigital, Inc.)**	UNITED STATES	ETSI
Intersec **(Intersec SA)**	FRANCE	ETSI

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Intertek **(Intertek)**	UNITED KINGDOM	ETSI
IPCom GmbH & Co.KG **(IPCom GmbH & Co.KG)**	GERMANY	ETSI
IPLOOK **(IPLOOK Networks Co., Ltd.)**	CHINA	CCSA
iQoo **(iQoo Software Technology (Shanghai) Co., Ltd.)**	CHINA	CCSA
Iridium Satellite LLC **(Iridium Satellite LLC)**	UNITED STATES	ATIS
IRT Saint Exupery **(Institut de recherche technologique Saint Exupery)**	FRANCE	ETSI
ISED **(Innovation, Science and Economic Development Canada)**	CANADA	ETSI
ISRO **(Indian Space Research Organisation)**	INDIA	TSDSI
ISSDU **(Information Security Service Digital United Inc.)**	TAIWAN, PROVINCE OF CHINA	ETSI
ITL **(Innovative Technology Lab Co., Ltd)**	KOREA (REPUBLIC OF)	TTA
ITOCHU Techno-Solutions Corp **(ITOCHU Techno-Solutions Corporation)**	JAPAN	TTC
ITRI **(Industrial Technology Research Institute)**	TAIWAN, PROVINCE OF CHINA	ETSI
ITRON SAS **(ITRON SAS)**	FRANCE	ETSI
Ittiam System Pvt Ltd **(Ittiam System Pvt Ltd)**	INDIA	TSDSI
Japan Radio Co., Ltd **(Japan Radio Co., Ltd)**	JAPAN	ARIB
Jetflow **(Jetflow Technologies Co., Ltd)**	CHINA	CCSA
Jio **(Jio Estonia OÜ)**	ESTONIA	ETSI
JMA Wireless **(JMA Wireless)**	UNITED STATES	ATIS
John Deere GmbH & Co. KG **(John Deere GmbH & Co. KG)**	GERMANY	ETSI
Johns Hopkins University APL **(Johns Hopkins University Applied Physics Laboratory)**	UNITED STATES	ATIS
JSI GmbH **(JSI GmbH)**	GERMANY	ETSI
Juniper Networks **(Juniper Networks)**	UNITED STATES	ETSI
Kapsch TrafficCom AG **(Kapsch TrafficCom AG)**	AUSTRIA	ETSI
KDDI Corporation **(KDDI Corporation)**	JAPAN	TTC
KDDI Corporation **(KDDI Corporation)**	JAPAN	ARIB
Kepler **(Kepler Communications GmbH)**	GERMANY	ETSI
Keysight Technologies UK Ltd **(Keysight Technologies UK Ltd)**	UNITED KINGDOM	ETSI
KIPO **(Korean Intellectual Property Office)**	KOREA (REPUBLIC OF)	TTA
Kontron Transportation France **(Kontron Transportation France S.A.S)**	FRANCE	ETSI
Korea Testing Laboratory **(Korea Testing Laboratory)**	KOREA (REPUBLIC OF)	TTA
KPN N.V. **(Koninklijke KPN N.V.)**	NETHERLANDS	ETSI
KRRI **(Korea Railroad Research Institute)**	KOREA (REPUBLIC OF)	TTA
KT Corp.	KOREA (REPUBLIC OF)	TTA

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(KT Corporation)		
Kymeta Corporation **(Kymeta Corporation)**	UNITED STATES	ETSI
Kyocera Corporation **(Kyocera Corporation)**	JAPAN	ARIB
Kyonggi University **(Kyonggi University)**	KOREA (REPUBLIC OF)	TTA
Kyoto University **(Kyoto University)**	JAPAN	ETSI
L.M. Ericsson Limited **(L.M. Ericsson Limited)**	IRELAND	ETSI
L3Harris Technologies **(L3Harris Technologies)**	UNITED STATES	ATIS
Langbo **(Shanghai Langbo Communication Technology Co., Ltd.)**	CHINA	CCSA
Lansus **(Lansus Technologies Inc.)**	CHINA	CCSA
LEGRAND FRANCE **(LEGRAND FRANCE ISERE)**	FRANCE	ETSI
Lekha Wireless Solutions **(Lekha Wireless Solutions Pvt Ltd)**	INDIA	TSDSI
Lenovo (Beijing) Ltd **(Lenovo (Beijing) Ltd)**	CHINA	CCSA
Lenovo Future Communications **(Lenovo Future Communications Technology (Chongqing) Co., Ltd.)**	CHINA	CCSA
Lenovo Information Technology **(Lenovo (Beijing) Information Technology Co., Ltd.)**	CHINA	CCSA
Leonardo SpA **(Leonardo SpA)**	ITALY	ETSI
LG Electronics Deutschland **(LG Electronics Deutschland GmbH)**	GERMANY	ETSI
LG Electronics Finland **(LG Electronics Finland Lab Oy)**	FINLAND	ETSI
LG Electronics France **(LG Electronics France)**	FRANCE	ETSI
LG Electronics Inc. **(LG Electronics Inc.)**	KOREA (REPUBLIC OF)	TTA
LG Electronics Polska **(LG Electronics Polska Sp. z.o.o.)**	POLAND	ETSI
LG Electronics UK **(LG Electronics UK Ltd)**	UNITED KINGDOM	ETSI
LG Uplus **(LG Uplus)**	KOREA (REPUBLIC OF)	TTA
Ligado Networks **(Ligado Networks)**	UNITED STATES	ETSI
LKA Niedersachsen **(Landeskriminalamt Niedersachsen)**	GERMANY	ETSI
Locaila **(Locaila)**	UNITED STATES	ATIS
Lockheed Martin **(Lockheed Martin)**	UNITED STATES	ATIS
Lynk Global **(Lynk Global)**	UNITED STATES	ATIS
Magister Solutions Ltd **(Magister Solutions Ltd)**	FINLAND	ETSI
Maketh Secure Limited **(Maketh Secure Limited)**	UNITED KINGDOM	ETSI
MATRIXX Software **(MATRIXX Software, Inc.)**	UNITED STATES	ETSI
Mavenir **(Mavenir Systems, Inc)**	UNITED STATES	ETSI
MaxWave Micro **(MaxWave Microelectronics Ltd.)**	CHINA	CCSA
MediaTek (Chengdu) Inc. **(MediaTek (Chengdu) Inc.)**	CHINA	CCSA

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MediaTek (Hefei) Inc. **(MediaTek (Hefei) Inc.)**	CHINA	CCSA
MediaTek (Shenzhen) Inc. **(MediaTek (Shenzhen) Inc.)**	CHINA	CCSA
MediaTek (Wuhan) Inc. **(MediaTek (Wuhan) Inc.)**	CHINA	CCSA
MediaTek Beijing Inc. **(MediaTek Beijing Inc.)**	CHINA	CCSA
MediaTek Inc. **(MediaTek Incorporated)**	TAIWAN, PROVINCE OF CHINA	ETSI
Mediatek India Technology Pvt. **(Mediatek India Technology Pvt. Ltd.)**	INDIA	TSDSI
MediaTek Korea Inc. **(MediaTek Korea Inc.)**	KOREA (REPUBLIC OF)	TTA
MediaTek UK **(MTK Wireless Ltd)**	UNITED KINGDOM	ETSI
MeitY **(Ministry of Electronics & Information Technology)**	INDIA	TSDSI
Meizu Technology **(Meizu Technology)**	CHINA	CCSA
Mercedes-Benz AG **(Mercedes-Benz AG)**	GERMANY	ETSI
Mesaqin.com s.r.o (Ltd.) **(Mesaqin.com s.r.o (Ltd.))**	CZECH REPUBLIC	ETSI
Meta India **(Meta India Online Services Pvt Ltd)**	INDIA	TSDSI
Meta Ireland **(Meta Platforms Ireland Ltd.)**	IRELAND	ETSI
Meta USA **(Meta USA)**	UNITED STATES	ATIS
Microchip Technology, Inc. **(Microchip Technology, Inc.)**	UNITED STATES	ATIS
Microsoft Europe SARL **(Microsoft Europe SARL)**	FRANCE	ETSI
MidWave Wireless **(MidWave Wireless)**	UNITED STATES	ATIS
MIMIT **(Ministry of Enterprises and Made in Italy)**	ITALY	ETSI
MinEA **(Ministry of Economic Affairs and Climate Policy)**	NETHERLANDS	ETSI
MINECO **(MINISTRY OF ECONOMIC AFFAIRS AND DIGITAL TRANSFORMATION)**	SPAIN	ETSI
MINISTERE DE L'INTERIEUR **(MINISTERE DE L'INTERIEUR)**	FRANCE	ETSI
Ministère Economie et Finances **(Ministère de l'Economie et des Finances)**	FRANCE	ETSI
Ministry of Transport SR **(Ministry of Transport of the Slovak Republic)**	SLOVAKIA	ETSI
MITRE Corporation **(MITRE Corporation)**	UNITED STATES	ETSI
Mitsubishi Electric Co. **(Mitsubishi Electric Co.)**	JAPAN	ARIB
Mitsubishi Electric Corp **(Mitsubishi Electric Corporation)**	JAPAN	TTC
Mitsubishi Electric RCE **(Mitsubishi Electric R&D Centre Europe)**	FRANCE	ETSI
Motorola Mobile Com Technology **(MOTOROLA MOBILE COMMUNICATION TECHNOLOGY LTD.)**	CHINA	CCSA
Motorola Mobility España SA **(Motorola Mobility España SA)**	SPAIN	ETSI
Motorola Mobility France S.A.S **(Motorola Mobility France S.A.S)**	FRANCE	ETSI
Motorola Mobility Germany GmbH **(Motorola Mobility Germany GmbH)**	GERMANY	ETSI
Motorola Mobility UK Ltd.	UNITED KINGDOM	ETSI

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(Motorola Mobility UK Ltd.)		
Motorola Solutions Germany **(Motorola Solutions Germany GmbH)**	GERMANY	ETSI
Motorola Solutions UK Ltd. **(Motorola Solutions UK Ltd.)**	UNITED KINGDOM	ETSI
MTCC **(Mobile Technology Convergence Center)**	KOREA (REPUBLIC OF)	TTA
Murata Manufacturing Co Ltd. **(Murata Manufacturing Co Ltd.)**	JAPAN	ARIB
MVG Industries **(MVG Industries)**	FRANCE	ETSI
Nanjing Ericsson Panda Com Ltd **(NANJING ERICSSON PANDA COMMUNICATIONS LTD)**	CHINA	CCSA
Nanjing Weibo **(Nanjing Weibo Software Technology Co., Ltd.)**	CHINA	CCSA
National Instruments Corp. **(National Instruments Corporation)**	UNITED STATES	ETSI
National Radio Research Agency **(National Radio Research Agency)**	KOREA (REPUBLIC OF)	TTA
National Spectrum Consortium **(National Spectrum Consortium)**	UNITED STATES	ATIS
National Technical Assistance **(National Technical Assistance Centre)**	UNITED KINGDOM	ETSI
nbn co Limited **(nbn co Limited (ABN 86 136 533 741))**	AUSTRALIA	ETSI
NCI Agency **(NATO Communication and Information Agency)**	NETHERLANDS	ETSI
NCIS **(National Criminal Investigation Service)**	NORWAY	ETSI
NCSC **(National Cyber Security Centre)**	UNITED KINGDOM	ETSI
NDRE **(National Defence Radio Establishment)**	SWEDEN	ETSI
NEC Corporation **(NEC Corporation)**	JAPAN	ARIB
NEC Corporation **(NEC Corporation)**	JAPAN	ETSI
NEC Corporation. **(NEC Corporation)**	JAPAN	TTC
NEC Europe Ltd **(NEC Europe Ltd)**	UNITED KINGDOM	ETSI
NEC Telecom MODUS Ltd. **(NEC Telecom MODUS Ltd.)**	UNITED KINGDOM	ETSI
NEMERGENT **(NEMERGENT SOLUTIONS SL)**	SPAIN	ETSI
NERCDTV **(Shanghai National Engineering Research Center of Digital Television Co.,Ltd.)**	CHINA	CCSA
Netherlands Police **(Netherlands Police, Division MDC)**	NETHERLANDS	ETSI
Netscout Systems Inc. **(Netscout Systems Inc.)**	UNITED STATES	ETSI
Network Rail **(Network Rail infrastructure limited)**	UNITED KINGDOM	ETSI
New H3C Technologies Co., Ltd. **(New H3C Technologies Co., Ltd.)**	CHINA	CCSA
NextNav **(NextNav)**	UNITED STATES	ATIS
NHK **(NHK (Japan Broadcasting Corporation))**	JAPAN	ARIB
NICT **(National Institute of Information and Communications Technology)**	JAPAN	ARIB
Niral **(Niral Networks Private Limited)**	INDIA	TSDSI
NIST **(National Institute of Standards and Technology)**	UNITED STATES	ATIS

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Nkom **(Norwegian Communications Authority)**	NORWAY	ETSI
Nokia **(Nokia)**	UNITED STATES	ATIS
Nokia Belgium **(Nokia Bell N.V.)**	BELGIUM	ETSI
Nokia Corporation **(Nokia Corporation)**	FINLAND	ETSI
Nokia Denmark **(Nokia Denmark A/S)**	DENMARK	ETSI
Nokia France **(Nokia Networks France)**	FRANCE	ETSI
Nokia Germany **(Nokia Solutions and Networks GmbH & Co. KG)**	GERMANY	ETSI
Nokia Hungary **(Nokia Solutions and Networks Kft.)**	HUNGARY	ETSI
Nokia Japan **(Nokia Japan)**	JAPAN	ARIB
Nokia Korea **(Nokia Korea)**	KOREA (REPUBLIC OF)	TTA
Nokia Poland **(Nokia Solutions and Networks Sp. z.o.o.)**	POLAND	ETSI
Nokia Shanghai Bell **(Nokia Shanghai Bell Co., Ltd)**	CHINA	CCSA
Nokia Solutions & Networks (I) **(Nokia Solutions and Networks India Pvt. Ltd.)**	INDIA	TSDSI
Nokia UK **(Nokia UK Ltd.)**	UNITED KINGDOM	ETSI
Nordic Semiconductor ASA **(Nordic Semiconductor ASA)**	NORWAY	ETSI
NOVAMINT **(NOVAMINT)**	UNITED KINGDOM	ETSI
NTIA **(National Telecommunications and Information Administration)**	UNITED STATES	ATIS
NTPU **(National Taipei University)**	TAIWAN, PROVINCE OF CHINA	ETSI
NTT **(Nippon Telegraph and Telephone Corporation (NTT))**	JAPAN	TTC
NTT corporation **(Nippon Telegraph and Telephone Corporation)**	JAPAN	ETSI
NTT DOCOMO INC. **(NTT DOCOMO INC.)**	JAPAN	TTC
NTT DOCOMO INC.. **(NTT DOCOMO INC.)**	JAPAN	ARIB
NTT-AT Corp. **(NTT Advanced Technology Corporation)**	JAPAN	TTC
NTU **(National Taiwan University)**	TAIWAN, PROVINCE OF CHINA	ETSI
Nubia Technology Co.,Ltd **(Nubia Technology Co.,Ltd)**	CHINA	CCSA
NUFRONT **(Nufront (Beijing) Technology Co., Ltd.)**	CHINA	CCSA
NVIDIA **(NVIDIA Corporation)**	UNITED STATES	ATIS
NXP Semiconductors Netherlands **(NXP Semiconductors Netherlands B.V.)**	NETHERLANDS	ETSI
NYCU **(National Yang Ming Chiao Tung University)**	TAIWAN, PROVINCE OF CHINA	ETSI
Odido **(Odido Netherlands B.V.)**	NETHERLANDS	ETSI
Ofcom (CH) **(Ofcom (CH))**	SWITZERLAND	ETSI
Ofcom (U.K.) **(Ofcom - Office of Communications (U.K.))**	UNITED KINGDOM	ETSI
Oki Electric Industry Co. Ltd.	JAPAN	TTC

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(OKi Electric Industry Co., Ltd)		
Omnispace **(Omnispace)**	UNITED STATES	ATIS
ONE Media 3.0 LLC **(ONE Media 3.0 LLC)**	UNITED STATES	ATIS
one2many B.V. **(one2many B.V.)**	NETHERLANDS	ETSI
OnePlus **(OnePlus (Shenzhen) Technology Co., LTD)**	CHINA	CCSA
OPPO **(Guangdong OPPO Mobile Telecommunications Corp.,Ltd.)**	CHINA	ETSI
OPPO (chongqing) Intelligence **(OPPO (chongqing) Intelligence Technology Limited)**	CHINA	CCSA
OPPO Beijing **(Beijing OPPO Telecommunications Corp., ltd.)**	CHINA	CCSA
OptM Media **(OptM Media Solutions Private Limited)**	INDIA	TSDSI
OQTEC **(OQ TECHNOLOGY)**	LUXEMBOURG	ETSI
Oracle Corporation **(Oracle Corporation)**	UNITED STATES	ETSI
Orange **(Orange)**	FRANCE	ETSI
Orange Romania **(Orange Romania)**	ROMANIA	ETSI
Orange Spain **(France Telecom España S.A.U.)**	SPAIN	ETSI
Orange UK **(Orange Brand Services Ltd)**	UNITED KINGDOM	ETSI
ORS **(Österreichische Rundfunksender GmbH & Co KG)**	AUSTRIA	ETSI
OTD_US **(OTD_US)**	UNITED STATES	ATIS
OTECH **(OTECH Germany GmbH)**	GERMANY	ETSI
P.I. WORKS **(P.I. WORKS TR BILISIM HIZMETLERI A.S.)**	TÜRKIYE	ETSI
Panasonic Holdings Corporation **(Panasonic Holdings Corporation)**	JAPAN	ARIB
PANASONIC R&D Center Germany **(PANASONIC R&D Center Germany GmbH)**	GERMANY	ETSI
PCCW Global B.V. **(PCCW Global B.V.)**	FRANCE	ETSI
Peking University **(Peking University)**	CHINA	CCSA
Pengcheng laboratory **(Pengcheng laboratory)**	CHINA	CCSA
Peraton Labs **(Peraton Labs)**	UNITED STATES	ATIS
Philips International B.V. **(Philips International B.V.)**	NETHERLANDS	ETSI
PHY Wireless **(PHY Wireless)**	UNITED STATES	ATIS
PIDS **(PIDS)**	NETHERLANDS	ETSI
Pivotal Commware **(Pivotal Commware)**	UNITED STATES	ATIS
Plan-S **(Plan S Uydu ve Uzay Teknolojileri A.S)**	TÜRKIYE	ETSI
PML **(Purple Mountain Laboratories: Networking, Communications and Security)**	CHINA	CCSA
Polaris Wireless **(Polaris Wireless)**	UNITED STATES	ATIS
Polisen **(Polismyndigheten)**	SWEDEN	ETSI

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POST Luxembourg **(POST Luxembourg)**	LUXEMBOURG	ETSI
Prasar Bharati **(Prasar Bharati)**	INDIA	TSDSI
Proximus Plc **(Proximus Plc)**	BELGIUM	ETSI
PSCE **(Public Safety Communication Europe Forum)**	BELGIUM	ETSI
PT PORTUGAL SGPS SA **(PT Portugal SGPS SA)**	PORTUGAL	ETSI
PTS **(Swedish Post and Telecom Authority)**	SWEDEN	ETSI
Public Safety Canada **(Public Safety Canada)**	CANADA	ETSI
Qihoo 360 **(Qihoo 360 Technology Co., Ltd.)**	CHINA	CCSA
Qorvo **(Qorvo)**	UNITED STATES	ETSI
Qualcomm Austria RFFE GmbH **(Qualcomm Austria RFFE GmbH)**	AUSTRIA	ETSI
QUALCOMM Europe Inc. - Italy **(QUALCOMM Europe Inc. - Italy Branch Office)**	ITALY	ETSI
QUALCOMM Europe Inc. - Spain **(QUALCOMM Europe Inc. - Spain Branch Office)**	SPAIN	ETSI
Qualcomm Finland RFFE Oy **(Qualcomm Finland RFFE Oy)**	FINLAND	ETSI
Qualcomm France **(Qualcomm France SARL)**	FRANCE	ETSI
Qualcomm Germany **(Qualcomm Germany GmbH)**	GERMANY	ETSI
Qualcomm Incorporated **(Qualcomm Incorporated)**	UNITED STATES	ATIS
Qualcomm India Pvt Ltd **(Qualcomm India Pvt Ltd)**	INDIA	TSDSI
QUALCOMM JAPAN LLC. **(QUALCOMM JAPAN LLC.)**	JAPAN	ARIB
Qualcomm Korea **(Qualcomm Korea)**	KOREA (REPUBLIC OF)	TTA
Qualcomm Tech. Netherlands B.V **(Qualcomm Technologies Netherlands B.V.)**	NETHERLANDS	ETSI
Qualcomm Technologies Int **(Qualcomm Technologies International, Ltd)**	UNITED KINGDOM	ETSI
Qualcomm Technologies Ireland **(QT Technologies Ireland Limited)**	IRELAND	ETSI
Quanray **(Shanghai Quanray Electronics Co., Ltd.)**	CHINA	CCSA
Quectel **(Quectel Wireless Solutions Co., Ltd.)**	CHINA	CCSA
RadiSys **(RadiSys Inc.)**	CANADA	ETSI
Rakuten Mobile, Inc **(Rakuten Mobile, Inc)**	JAPAN	ARIB
RATEL **(Regulatory Authority For Electronic Communications and Postal Services)**	SERBIA	ETSI
Reliance Jio **(Reliance Jio)**	INDIA	TSDSI
RICHTEK KOREA **(RICHTEK KOREA)**	KOREA (REPUBLIC OF)	TTA
RISE **(RISE Research Institutes of Sweden)**	SWEDEN	ETSI
ROBERT BOSCH GmbH **(ROBERT BOSCH GmbH)**	GERMANY	ETSI
Rogers Communications Canada **(Rogers Communications Canada Inc.)**	CANADA	ETSI
ROHDE & SCHWARZ	GERMANY	ETSI

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(ROHDE & SCHWARZ GmbH & Co.KG)		
Ruijie Network Co. Ltd **(Ruijie Network Co. Ltd)**	CHINA	CCSA
SAICT **(Shenzhen Academy of Information and Communication Technology)**	CHINA	CCSA
Samsung Electronics Co., Ltd **(Samsung Electronics Co., Ltd.)**	KOREA (REPUBLIC OF)	TTA
Samsung Electronics Czech **(Samsung Electronics Czech)**	CZECH REPUBLIC	ETSI
Samsung Electronics France SA **(Samsung Electronics France SA)**	FRANCE	ETSI
Samsung Electronics GmbH **(Samsung Electronics GmbH)**	GERMANY	ETSI
Samsung Electronics Iberia SA **(Samsung Electronics Iberia SA)**	SPAIN	ETSI
Samsung Electronics Nordic AB **(Samsung Electronics Nordic AB)**	SWEDEN	ETSI
Samsung Electronics Polska **(Samsung Electronics Polska)**	POLAND	ETSI
Samsung Guangzhou Mobile R&D **(Samsung Guangzhou Mobile R&D Center)**	CHINA	CCSA
Samsung Nanjing **(Samsung Electronic (China) R&D Center)**	CHINA	CCSA
Samsung R&D Institute India **(Samsung R&D Institute India - Bangalore Pvt. Ltd)**	INDIA	TSDSI
SAMSUNG R&D INSTITUTE JAPAN **(SAMSUNG R&D INSTITUTE JAPAN)**	JAPAN	ARIB
Samsung R&D Institute UK **(Samsung R&D Institute UK)**	UNITED KINGDOM	ETSI
Samsung Research America **(Samsung Research America)**	UNITED STATES	ATIS
Samsung Shenzhen **(Samsung Network R&D Center-Shenzhen)**	CHINA	CCSA
Sandvine Incorporated **(Sandvine Incorporated)**	CANADA	ETSI
Sanechips **(Sanechips Technology Co. , Ltd.)**	CHINA	CCSA
Sateliot **(Satelio IoT Services)**	SPAIN	ETSI
Schindler **(Schindler Elevator Ltd)**	SWITZERLAND	ETSI
SDI Squared **(SDI Squared LLC)**	UNITED STATES	ETSI
Sectra Communications AB **(Sectra Communications AB)**	SWEDEN	ETSI
Security Service **(Swedish Security Service)**	SWEDEN	ETSI
Semtech Neuchatel SA **(Semtech Neuchatel SA)**	SWITZERLAND	ETSI
Sennheiser Electronic GmbH **(Sennheiser Electronic GmbH & Co. KG)**	GERMANY	ETSI
Sensus UK **(Sensus UK Systems Limited)**	UNITED KINGDOM	ETSI
Sepura Ltd **(Sepura Limited)**	UNITED KINGDOM	ETSI
Sequans Communications **(Sequans Communications)**	FRANCE	ETSI
SES S.A. **(SES S.A.)**	LUXEMBOURG	ETSI
SETS **(Society for Electronic Transactions and Security)**	INDIA	TSDSI
SEU **(Southeast University)**	CHINA	CCSA
SGDSN **(Secrétariat Général de la Défense et de la Sécurité Nationale (SGDSN))**	FRANCE	ETSI

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SGITG **(State Grid Information & Telecommunication Group Co., Ltd.)**	CHINA	CCSA
SGS Wireless **(SGS Wireless)**	UNITED KINGDOM	ETSI
Shanghai Chen Si Electronics **(Shanghai Chen Si Electronics Technology Co., Ltd)**	CHINA	CCSA
Shanghai Jiao Tong University **(Shanghai Jiao Tong University)**	CHINA	CCSA
Shanghai Tejet Com Technology **(Shanghai Tejet Communications Technology Co., Ltd.)**	CHINA	CCSA
SHARP Corporation **(SHARP Corporation)**	JAPAN	ARIB
Shenzhen Heytap **(Shenzhen Heytap Technology Corp.,Ltd.)**	CHINA	CCSA
ShenZhen Zhongxing Shitong **(ShenZhen Zhongxing Shitong Tech. Co.,Ltd.)**	CHINA	CCSA
SIA **(Shenyang Institute of Automation, Chinese Academy of Sciences)**	CHINA	CCSA
Siemens AG **(Siemens AG)**	GERMANY	ETSI
Signalchip Innovations Pvt. **(Signalchip Innovations Pvt. Ltd.)**	INDIA	TSDSI
SIST **(Slovenian Institute for Standardisation)**	SLOVENIA	ETSI
Sisvel **(Sisvel International S.A.)**	LUXEMBOURG	ETSI
SK Telecom **(SK TELECOM)**	KOREA (REPUBLIC OF)	TTA
SKY Perfect JSAT Corporation **(SKY Perfect JSAT Corporation)**	JAPAN	ARIB
Skylo Technologies **(Skylo Technologies)**	UNITED STATES	ATIS
Skyworks Solutions Inc. **(Skyworks Solutions Inc.)**	UNITED STATES	ETSI
SmarterMicro Inc. **(Smarter Microelectronics(Guangzhou) Co.,Ltd)**	CHINA	CCSA
SnT - University of Luxembourg **(Interdisciplinary Centre for Security, Reliability and Trust/University of Luxembourg)**	LUXEMBOURG	ETSI
SoftBank Corp. **(SoftBank Corp.)**	JAPAN	ARIB
Softel Systems **(Softel Systems Pty Ltd)**	AUSTRALIA	ETSI
Softil Ltd **(Softil Ltd)**	ISRAEL	ETSI
Sony Corporation **(Sony Corporation)**	JAPAN	ARIB
Sony Europe B.V. **(Sony Europe B.V.)**	UNITED KINGDOM	ETSI
Sony Group Corporation **(Sony Group Corporation)**	JAPAN	ARIB
Sooktha Consulting Pvt Ltd **(Sooktha Consulting Pvt Ltd)**	INDIA	TSDSI
Southern Linc. **(Southern Linc.)**	UNITED STATES	ATIS
Southwest Jiaotong university **(Southwest Jiaotong university)**	CHINA	CCSA
SpaceX **(SpaceX Netherlands B.V)**	NETHERLANDS	ETSI
Spark NZ Ltd **(Spark NZ Ltd)**	NEW ZEALAND	ATIS
Spirent Communications **(Spirent Communications)**	UNITED STATES	ETSI
Sporton International Inc **(Sporton International Inc.)**	TAIWAN, PROVINCE OF CHINA	ETSI
Spreadtrum Communications	CHINA	CCSA

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(Spreadtrum Communications (Shanghai) Co., Ltd.)		
SRTC **(The State Radio_monitoring_center Testing Center)**	CHINA	CCSA
SS8 **(SS8 Networks Inc.)**	UNITED STATES	ETSI
SSNS **(Special Service for the National Security of Hungary)**	HUNGARY	ETSI
Starpoint **(Beijing Starpoint Technology Company Limited)**	CHINA	CCSA
STE IDIRECT IRELAND LTD **(ST ENGINEERING IDIRECT (IRELAND) LIMITED)**	IRELAND	ETSI
Stellar **(Stellar telecommunications)**	FRANCE	ETSI
STMicroelectronics **(STMicroelectronics International NV)**	SWITZERLAND	ETSI
Sumitomo Elec. Industries, Ltd **(Sumitomo Electric Industries, Ltd.)**	JAPAN	ARIB
SUTD **(Singapore University of Technology and Design)**	SINGAPORE	ETSI
Swift Navigation **(Swift Navigation)**	UNITED STATES	ATIS
SWISSCOM **(SWISSCOM SA)**	SWITZERLAND	ETSI
SWR **(Südwestrundfunk)**	GERMANY	ETSI
SyncTechno Inc. **(SyncTechno Inc.)**	KOREA (REPUBLIC OF)	TTA
Syniverse **(M/s Syniverse Technologies Services India Pvt. Ltd.)**	INDIA	TSDSI
TA **(Tantra Analyst)**	UNITED STATES	ETSI
Tait Europe Limited **(Tait Europe Limited)**	AUSTRIA	ETSI
Tata Elxsi Limited. **(Tata Elxsi Limited.)**	INDIA	TSDSI
TCL **(Shenzhen TCL New Technology Company Ltd.)**	CHINA	CCSA
TCS **(TATA Consultancy Services)**	INDIA	TSDSI
TD Tech Ltd **(TD Tech Ltd)**	CHINA	CCSA
TDF **(TDF SAS)**	FRANCE	ETSI
Tech Mahindra Limited **(Tech Mahindra Limited)**	INDIA	TSDSI
Tejas Network Limited **(Tejas Network Limited)**	INDIA	TSDSI
Tektronix GmbH **(Tektronix GmbH)**	GERMANY	ETSI
TELECOM ITALIA S.p.A. **(Telecom Italia S.p.A.)**	ITALY	ETSI
Telefonica Germany GmbH **(Telefónica Germany GmbH & Co OHG)**	GERMANY	ETSI
TELEFONICA S.A. **(TELEFONICA S.A.)**	SPAIN	ETSI
Telekom Deutschland GmbH **(Telekom Deutschland GmbH)**	GERMANY	ETSI
TELENOR ASA **(Telenor ASA)**	NORWAY	ETSI
Telesat International Limited **(Telesat International Limited)**	UNITED KINGDOM	ETSI
Telia Company AB **(Telia Company AB)**	SWEDEN	ETSI
Telit Communications S.p.A. **(Telit Communications S.p.A.)**	ITALY	ETSI

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Telstra Limited **(Telstra Limited)**	AUSTRALIA	ETSI
TELUS **(TELUS)**	CANADA	ATIS
Tencent **(Shenzhen city Tencent computer system Co. Ltd.)**	CHINA	CCSA
Tencent Cloud **(Tencent cloud computing Beijing Co., Ltd)**	CHINA	CCSA
Teradyne **(Teradyne)**	UNITED STATES	ATIS
TerreStar Solutions Inc. **(TerreStar Solutions Inc.)**	CANADA	ATIS
Texas A&M University **(Texas A&M University)**	UNITED STATES	ETSI
TEXAS Instruments **(Texas Instruments France)**	FRANCE	ETSI
THALES **(THALES)**	FRANCE	ETSI
THURAYA TELECOM CO. **(THURAYA TELECOMMUNICATIONS COMPANY)**	UNITED ARAB EMIRATES	ETSI
Tiami Networks **(Tiami Networks)**	UNITED STATES	ATIS
TII **(Technology Innovation Institute)**	UNITED ARAB EMIRATES	ETSI
T-Mobile Austria GmbH **(T-Mobile AUSTRIA GmbH)**	AUSTRIA	ETSI
T-Mobile Polska S.A. **(T-Mobile Polska Spolka Akcyjna)**	POLAND	ETSI
T-Mobile USA **(T-Mobile USA, Inc.)**	UNITED STATES	ETSI
T-Mobile USA Inc. **(T-Mobile USA Inc.)**	UNITED STATES	ATIS
TNO **(TNO)**	NETHERLANDS	ETSI
Tongji University **(Tongji University)**	CHINA	CCSA
Toshiba **(Toshiba)**	UNITED KINGDOM	ETSI
TOWE Wireless **(Sushi TOWE Wireless Testing (Shenzhen) Co.,Ltd.)**	CHINA	ETSI
TOYOTA Info Technology Center **(TOYOTA Info Technology Center USA, Inc.)**	UNITED STATES	ETSI
TOYOTA MOTOR CORPORATION **(TOYOTA MOTOR CORPORATION)**	JAPAN	TTC
TRAFICOM **(The Finnish Transport and Communications Agency)**	FINLAND	ETSI
Trafikverket **(Trafikverket)**	SWEDEN	ETSI
Transsion Holdings **(Transsion Holdings)**	CHINA	CCSA
TransUnion **(TransUnion)**	UNITED STATES	ATIS
Trimble **(Trimble)**	UNITED STATES	ATIS
Tron Future Tech Inc. **(Tron Future Tech Inc.)**	TAIWAN, PROVINCE OF CHINA	ETSI
TTP plc **(TTP plc)**	UNITED KINGDOM	ETSI
Turk Telekomunikasyon A.S. **(Turk Telekomunikasyon A.S.)**	TÜRKIYE	ETSI
TURKCELL **(Turkcell Iletisim Hizmetleri A.S.)**	TÜRKIYE	ETSI
U.S. Department of Defense **(U.S. Department of Defense)**	UNITED STATES	ATIS
U.S. Department of Transport.	UNITED STATES	ATIS

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(U.S. Department of Transportation)		
U.S. National Security Agency **(US National Security Agency)**	UNITED STATES	ATIS
Uangel **(Uangel Corporation)**	KOREA (REPUBLIC OF)	TTA
ubinexus **(Beijing Ubinexus Technology Development Co., Ltd)**	CHINA	CCSA
u-blox AG **(u-blox AG)**	SWITZERLAND	ETSI
UESTC **(University of Electronic Science and Technology of China)**	CHINA	CCSA
UL VS Ltd **(UL VS Ltd)**	UNITED KINGDOM	ETSI
UMA **(Universidad de Malaga)**	SPAIN	ETSI
umlaut **(umlaut communications GmbH)**	GERMANY	ETSI
UNIBO **(ALMA MATER STUDIORUM Università di Bologna)**	ITALY	ETSI
UniBw M **(University of the Bundeswehr Munich)**	GERMANY	ETSI
Unicom Broadband Online **(Unicom Broadband Online Co., Ltd.)**	CHINA	CCSA
Unicompay **(Unicompay Co., Ltd.)**	CHINA	CCSA
Union Inter. Chemins de Fer **(Union Internationale des Chemins de Fer)**	FRANCE	ETSI
Union Telephone Company **(Union Telephone Company)**	UNITED STATES	ATIS
Unisoc **(Unisoc (Shanghai) Technologies Co., Ltd.)**	CHINA	CCSA
Unisoc Beijing **(Beijing Unisoc Communications Technology Co., Ltd.)**	CHINA	CCSA
UPV/EHU **(Universidad del País Vasco/Euskal Herriko Unibertsitatea)**	SPAIN	ETSI
US Cellular Corporation. **(US Cellular Corporation/TDS.)**	UNITED STATES	ATIS
UTIMACO TS GmbH **(UTIMACO TS GmbH)**	GERMANY	ETSI
UTokyo **(The University of Tokyo)**	JAPAN	ETSI
Vaan Megam **(Vaan Megam Networks)**	INDIA	TSDSI
Valeo **(Valeo Telematik und Akustik GmbH)**	GERMANY	ETSI
VALID SOLUCIONES TECNOLÓGICAS **(VALID SOLUCIONES TECNOLÓGICAS S.A.U)**	SPAIN	ETSI
Valid8 **(Valid8.com, Inc.)**	UNITED STATES	ETSI
Vanchip **(Vanchip (Tianjin) Technology Co., Ltd.)**	CHINA	CCSA
Verizon Denmark **(Verizon Denmark A/S)**	DENMARK	ETSI
Verizon Spain **(Verizon Spain S.L.)**	SPAIN	ETSI
Verizon Sweden **(Verizon Sweden Aktiebolag 2116)**	SWEDEN	ETSI
Verizon Switzerland AG **(Verizon Switzerland AG)**	SWITZERLAND	ETSI
Verizon UK Ltd **(Verizon UK Ltd)**	UNITED KINGDOM	ETSI
Vestel **(Vestel Elektronik Sanayi ve Ticaret A.S)**	TÜRKIYE	ETSI
ViaSat Satellite Holdings Ltd **(ViaSat Satellite Holdings Ltd)**	UNITED KINGDOM	ETSI

VIAVI Solutions **(Viavi Solutions UK Ltd.)**	UNITED KINGDOM	ETSI
vivo Mobile Com. (Chongqing) **(vivo Mobile Communication (Chongqing) Co., Ltd)**	CHINA	CCSA
vivo Mobile Communication (H) **(vivo Mobile Communication (Hangzhou) Co., Ltd.)**	CHINA	CCSA
vivo Mobile Communication (S) **(vivo Mobile Communication (Shenzhen) Co., Ltd.)**	CHINA	CCSA
vivo Mobile Communication Co., **(vivo Mobile Communication Co., Ltd)**	CHINA	CCSA
VIVO TECH GmbH **(VIVO TECH GmbH)**	GERMANY	ETSI
Vodafone GmbH **(Vodafone GmbH)**	GERMANY	ETSI
VODAFONE Group Plc **(Vodafone Group Plc)**	UNITED KINGDOM	ETSI
Vodafone Ireland Plc **(Vodafone Ireland Plc)**	IRELAND	ETSI
Vodafone Italia SpA **(Vodafone Italia SpA)**	ITALY	ETSI
Vodafone Romania S.A. **(Vodafone Romania S.A.)**	ROMANIA	ETSI
Vodafone Telekomünikasyon A.S. **(Vodafone Telekomünikasyon A.S.)**	TÜRKIYE	ETSI
VoiceAge Corporation **(VoiceAge Corporation)**	CANADA	ETSI
Volkswagen AG **(Volkswagen AG)**	GERMANY	ETSI
VSENS **(Unicom Vsens Telecommunications Co., Ltd)**	CHINA	CCSA
VTT **(VTT Technical Research Centre of Finland)**	FINLAND	ETSI
WE Certification Oy **(WE Certification Oy)**	FINLAND	ETSI
Wiliot Ltd. **(Wiliot Ltd.)**	ISRAEL	ETSI
WILUS Inc. **(WILUS Inc.)**	KOREA (REPUBLIC OF)	TTA
Wipro GE **(Wipro GE Healthcare Private Limited)**	INDIA	TSDSI
Wisig Networks Pvt Ltd **(Wisig Networks Pvt Ltd)**	INDIA	TSDSI
Wuhan CICT Mobile **(Wuhan CICT Mobile Communications Technology Co., Ltd.)**	CHINA	CCSA
Wuhan Hongxin Technical **(Wuhan Hongxin Technical Services Co., Ltd.)**	CHINA	CCSA
Wuhan Hongxin Technology **(Wuhan Hongxin Technology Development Co., Ltd.)**	CHINA	CCSA
Xiaomi Communications **(Xiaomi Communications)**	CHINA	CCSA
Xiaomi EV Technology **(Xiaomi EV Technology Co., Ltd.)**	CHINA	CCSA
Xiaomi Technology **(Xiaomi Technology)**	CHINA	CCSA
Xidian University **(Xidian University)**	CHINA	CCSA
Xilinx Ireland **(Xilinx Ireland)**	IRELAND	ETSI
Zhejiang Lab **(Zhejiang Lab)**	CHINA	CCSA
Zhejiang University **(Zhejiang University)**	CHINA	CCSA
ZITiS **(Central Office for Information Technology in the Security Sector)**	GERMANY	ETSI
Zollkriminalamt (ZKA)	GERMANY	ETSI

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(Zollkriminalamt (ZKA))		
ZONSON **(ZONSON SAMRT AUTO CORPORATION)**	CHINA	CCSA
ZTE **(ZTE Telecom India Pvt Ltd)**	INDIA	TSDSI
ZTE Corporation **(ZTE Corporation)**	CHINA	CCSA
ZTE Corporation **(ZTE Corporation)**	CHINA	ETSI
ZTE FRANCE SASU **(ZTE FRANCE SASU)**	FRANCE	ETSI
ZTE Italia **(ZTE Italia S.R.L)**	ITALY	ETSI
ZTE JAPAN K.K. **(ZTE JAPAN K.K..)**	JAPAN	TTC
ZTE Japan K.K. **(ZTE Japan K.K.)**	JAPAN	ARIB
ZTE Korea Limited **(ZTE Korea Limited)**	KOREA (REPUBLIC OF)	TTA
ZTE Photonics **(ZTE Photonics Technology Co.,Ltd.)**	CHINA	CCSA
ZXNE **(ZXNE CORPORATION)**	CHINA	CCSA

Total : 781 Individual Members

Any comments or problems with this application? Please let us know...

APPENDIX 10

The Wayback Machine - https://web.archive.org/web/20160703100447/http://www.3gpp.org:80/about-3gpp/3gpp-faqs

3GPP FAQs

3GPP FAQs

Questions about 3GPP Membership
Questions about 3GPP email exploder lists
Questions about Legal Matters
Questions about 3GPP Specifications
Questions about Technical Specification Group/Working Group
Questions about Documents and TSG/WG Meetings
Questions about Work Items and Deliverables
Miscellaneous
Technical topics

Questions about 3GPP Membership

Who can become an Individual Member of 3GPP and how much does it cost?
Who may participate in 3GPP meetings?
Who shall fill in the 3GPP Individual Member Application form?
What shall I do if a 3GPP company or official contact details change?
What are the different membership categories?
Who may become an observer?
Who may become a Guest Member and do guests have to pay any fees?
Who can apply for market representative Partnership?
Can an ETSI Observer become an Individual Member of 3GPP?
Can an ETSI Applicant apply for 3GPP Membership?
Can an ETSI Member apply for 3GPP Guest status?

Questions about 3GPP email exploder lists

Are there discussion archives for the 3GPP exploder lists?
How do I subscribe to the 3GPP exploder lists?

Questions about Legal Matters

What is the 3GPP IPR Policy?
What is the 3GPP policy on licensing?
Who owns the Technical Specifications and the Technical Reports approved by 3GPP?
Are meeting contributions to ETSI TC SMG publically available?
Is permission needed to use the 3GPP logo in marketing collaterals or on a web site?
Can I use computer code included with a 3GPP TS to implement a product?

Questions about 3GPP Specifications

How do I create the next Release version of a TS or TR?
Where can the rules, protocols or software needed to develop applications for UMTS be found?
What is the correlation between Stage 1, Stage 2 and Stage 3?
Are the 3GPP specifications produced only in word?
Which group works with specifications covering the use of the GSM codec (either in C or Java based)?
Where can I find documents produced by the GSM MoU Group / GSM Association?
Where would I find a document (e.g. UMTS 30.03 version 3.1.0) which does not appear on the status list?
Where are all the Change Requests (CRs) located?
Where are all the current ETSI SMG specs located?
Which group works on Physical Layer aspects of UMTS/LTE?
Where can I find the list of Abstract syntax notation (ASN.1) object identifiers?
Where can I find the 3GPP Confidentiality and Integrity algorithms?
What is a Release - how does specification version numbering work?
Where can I find information on the current status of 3GPP specifications?
What is the system for numbering specifications?
What is the meaning of the text at the foot of the TS/TR cover page?

Questions about Technical Specification Group/Working Group

Who are the TSG/WG Officials and Support team and where can I find their contact details?
Where can I find the Terms of Reference for my TSG/WG?

Search

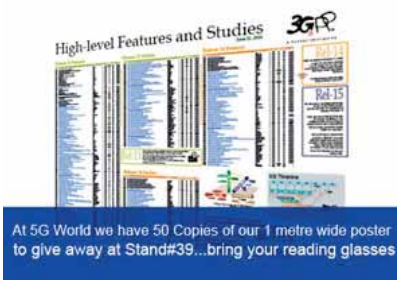
3GPP Website: Search for...

Search and download specs, docs, CRs and more from the 3GPP FTP Server:

ADVANCED FTP SEARCH

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News Feeds

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Technical topics

What formalities do I have to go through to get type approval for terminal equipment in Europe? Is there a single point of contact? What standards does my equipment need to conform to in order that I can place it on the market?
Where can I find a list of technical terms and abbreviations used in 3GPP documents?
What is the difference between a SIM and a USIM? What is a UICC?
I have transferred a video file from my phone to my PC. Where can I find a player for 3gp files?
Where can I find the specification of the SIM Lock feature?

Who can become an Individual Member of 3GPP and how much does it cost?

Individual Members are by definition members of the Organizational Partners of 3GPP. This means that members of standardization bodies such as ETSI, ARIB, TTA, TTC, ATIS and CCSA have a right to take part in 3GPP. If your company becomes an ETSI member, please be informed that for participation in 3GPP you need to pay 3 units of contribution as a minimum except SMEs, Users, Universities, Public Research Bodies who should pay 2 units (instead of 1).

ETSI Members' and associate members' fees are calculated by class. The class is derived from the member company's annual ECRT band (Electronics Communications Related Turnover) – see ECRT definition.
Each class corresponds to a number of units. This number determines the contribution payable.

Example: If your organization declares an annual ECRT of up to 135€ million, you would need to pay 2 Units of Contribution (corresponding to 9380€ per year) plus an additional UoC for participation in 3GPP of 3380€ (see fees table). Members joining ETSI during the 2nd half of the year benefit from a 50% rebate on the membership fee of the current year. In this case, you would pay 12760€ minus 50% = 6380€ for yyyy.

Who may participate in 3GPP meetings?

To attend a 3GPP meeting, you must be a 3GPP Individual Member (i.e., you must be a Member of one of the Organizational Partners involved in the project; ARIB, CCSA, ETSI, ATIS, TTA or TTC). A non-member company should seek membership with one of the above partners to be eligible to contribute and participate at 3GPP Meetings.

Who shall fill in the 3GPP Individual Member Application form?

The person legally responsible for the requesting company shall fill in the form.

What shall I do if a 3GPP company or official contact details change?

All changes of correspondence should be notified to ETSI Membership and 3GPPMembership.
In case of change of official contact an ETSI Online (EOL) account will be created for the new contact.
Please note that as official contact person you can view and modify your personal and organization's contact details via the "Manage my membership" web interface.

What are the different membership categories?

The different membership categories of 3GPP are described in Article 4 of the 3GPP Working Procedures.

Who may become an observer?

The status of Observer may be granted by the Organizational Partners to an entity which has the qualifications to become a future Partner (see also 3GPP Working Procedures Article 10)

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Who may become a 3GPP Guest Member and do guests have to pay any fees?

The 3GPP Guest status is for potential Individual Members who may be granted permission to participate in 3GPP for a maximum period of 6 months. Guest status is granted on a case-by-case basis by the Organizational Partners (see also 3GPP Working Procedures Article 10). If you like to apply for a Guest status, please complete the on-line 3GPP Application form.

No membership fees are requested for Guest applications. The Guest status is a one time only membership which is used to enable a company to decide whether or not they wish to become a full member (by joining one of the Partners).

Who can apply for market representative Partnership?

Organisation who have the ability to offer market advice to 3GPP and to bring into 3GPP a consensus view of market requirements (e.g., services, features and functionality) falling within the 3GPP scope (see also 3GPP Working Procedures, Article 7).

Can an ETSI Observer become an Individual Member of 3GPP?

An ETSI Observer cannot become an Individual Member of 3GPP. An ETSI Observer may "observe" all activities, but their participation is limited to the ETSI General Assembly only. Therefore, ETSI Observers have no participation rights in 3GPP. ETSI Observers have access to ETSI documentation and of course to 3GPP documentation since that is openly published on the web.

3GPP does have it's own category called "Observer" but that is entirely different and is used for potential Partners.

Can an ETSI Applicant apply for 3GPP Membership?

YES, an ETSI Applicant means that your request to become an ETSI Member will be addressed (and normally approved) at the next General Assembly and that the company has specified they want to participate in 3GPP activities. See also above regarding 3GPP fees.

Can an ETSI Member apply for 3GPP Guest status?

Yes, any ETSI Member can apply for a 3GPP Guest status by filling in the on-line 3GPP Application form.

Are there discussion archives for the 3GPP exploder lists?

Yes! To see the complete list please have a look here: Home page of listserv and scroll down until you find the list you are interested in. For example, the archives for the main RAN email list.

How do I subscribe to the 3GPP exploder lists?

All 3GPP email exploder lists can be found at list.3gpp.org. In order to subscribe to any of the lists, scroll down until you find the list you are interested in, then click on the link and on the right side of the page you will find Subscribe or Unsubscribe. Click on the link and follow the simple instructions. Delegates who already have an ETSI username and password should use the list management application on the ETSI site.

What is the 3GPP IPR Policy?

The 3GPP Organizational Partners have agreed that their IPR policies should be respected and that their respective members should be encouraged to declare "their willingness to grant licenses on fair, reasonable terms and conditions and on non discriminatory basis" (Article 3.1 of the Third Generation Partnership Project). For more information, look here >>>

The above-mentioned principles are further reflected in Article 55 of the 3GPP Working Procedures which request that each Individual Members should declare "at the earliest opportunity, any IPR which they believe to be essential, or potentially essential, to any work ongoing within 3GPP".

What is the 3GPP policy on licensing?

Some aspects of 3GPP systems are covered by essential Intellectual Property Rights (IPR) - that is, patented technologies without which equipment cannot be implemented. The IPR vests in - i.e. the patents are held by - individual companies, and not by 3GPP itself or any of its Organizational Partners (OPs). All Individual Members of 3GPP abide by the IPR policies of the OP to which they belong; all such policies are broadly similar see also "What is the 3GPP IPR Policy", and require IPR holders to make licences available to all third parties, whether or not they are 3GPP Individual Members, under fair, reasonable and non-discriminatory (FRAND) terms.

Neither 3GPP nor its component OPs offer an IPR search service. It is the responsibility of each manufacturer / system implementor to seek and obtain its own licenses from the individual IPR holders. For more information, and a guide to the IPRs declared to each 3GPP OP, look here>>>

Who owns the Technical Specifications and the Technical Reports approved by 3GPP?

According to the Article 3.2.2 of the Third Generation Partnership Project Agreement, the 3GPP Organizational Partners jointly own copyright on the Technical Specifications and the Technical Reports approved by 3GPP.

Are meeting contributions to ETSI TC SMG publically available?

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ETSI TC SMG meeting documents can be found on the ETSI docbox file server. Access is limited to bona fide representatives of ETSI member organizations. These, together with early versions of the GSM specifications, have been gathered together into a set of DVDs "A Technical History of GSM" available to ETSI members via the ETSI WEB store.

The GSM standardization work was transferred from CEPT to ETSI in 1991. TC SMG was closed at meeting #32 and TC SMG created to continue the work. Like almost all ETSI Technical Committees, participation in TC SMG and its working groups was open to all ETSI member organizations. That is, any bona fide representative of an ETSI member was free to participate. Exceptionally, other individuals could participate by express invitation of the chairman. Each meeting report contains a list of participants with their corporate affiliations.

Until the late 1990s, all meeting documents were circulated in paper form. Electronic files started to take over from paper in around 1997. Meeting documents ("TDocs") were distributed by post (later, by fax) in batches prior to the meeting, to those persons registered as regular participants in SMG or the appropriate working group, and many more documents were produced during the course of the meeting itself. Although a provision existed (and still exists) in the context of the IPR Policy for contributors to place restrictions on the distribution of TDocs via a formal notification at the time the document was provided, this was seldom if ever invoked. In the absence of such a condition, all TDocs were free of any restriction on subsequent distribution. Thus no restriction has ever been placed on how meeting participants dispose of the documents subsequent to their distribution before, during, or after the meeting. There were no non-disclosure agreements.

ETSI maintains a paper archive of the SMG TDocs, and bona fide representatives of current ETSI members can, by appointment, make an accompanied search of the archives. This facility extends to members which may not have been members at the time the document was originally produced.

TC-approved versions of ETSI “deliverables” (see ETSI Directives for formal definition of this term) would have been transferred by the support officer of the committee to the secretariat team responsible for publishing ETSI deliverables. That team would have made cosmetic (non-technical) modifications to the draft deliverables before issuing them. Depending on the type of “deliverable”, those documents would have been issued via National Standards Organizations (NSOs) either for immediate publication, or first via either a one-step or two-step national public enquiry and vote process prior to final publication by ETSI. In ETSI parlance, “publication” of a deliverable is the final step in the development cycle of a technical standard, and has a precise meaning. That meaning is not “making publically available”, since draft deliverables released for public enquiry or for vote are "publically available" but not yet "published".

If the confidentiality conditions described above had been imposed on a TDoc by its authors, if the text of that TDoc was in due course incorporated into an ETSI "deliverable", then those conditions are regarded as annulled from the date on which the deliverable is published.

Collections of TDocs / meeting reports have from time to time been made available to ETSI members in CD or DVD form, look here >>>

Is permission needed to use the 3GPP logo in marketing collaterals or on a web site?

ETSI (European Telecommunications Standards Institute) is the sole owner of the following acronyms:

ETSI,
DECT,
UMTS,
3GPP and
TIPHON,

as well as the ETSI, TIPHON, 3GPP and LTE logos. ETSI Members are authorized to use these Trade Marks in accordance with Collective Letter 1943. Authorization is needed to use the above mentioned acronyms and logos.

For further information contact the ETSI Legal Team or see http://www.3gpp.org/about-3gpp/legal-matters/logo-use.

Can I use computer code included with a 3GPP TS to implement a product?

Yes, but read this clause carefully. Some 3GPP Technical Specifications include computer code such as ASN.1 or XML (protocols), ANSI-C language (codecs), ...; and some include test vectors (codecs) for verifying implementations. These are published to allow users of these TSs to implement real-world products. No permission is required from 3GPP or its Organizational Partners (OPs) to use this code in the design of products - e.g. to compile the C to implement a codec in machine code.

Nevertheless, there may be essential IPR involved with such a design, and implementers are obliged to seek licences from IPR owners to use that technology. See also What is the 3GPP policy on licensing?

Moreover, the copyright of all 3GPP TSs and TRs vests jointly by all the 3GPP OPs. Other than for in-house copies for the purpose of further development of the 3GPP standard or for product design purposes, etc. you may not reproduce any part of a 3GPP TS or TR without seeking permission from 3GPP (e.g. from the ETSI Legal Team): use the procedure described on the legal area of this site. This means that you must not provide verbatim copies of source code (or lightly modified copies) without seeking permission from 3GPP.

Finally, you are reminded that 3GPP TSs and TRs have no legal status, and you should not design products directly to them. See the advice notice on the cover page of every 3GPP TS and TR. Instead, use the technically identical publication of one of the OPs.

How do I create the next Release version of a TS or TR?

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There are three ways of upgrading a Release X spec to Release X+1:

1. Write a CR to the latest Release X version to incorporate technical changes to satisfy a Release X+1 work item, and on the cover sheet showing the WI code for that work item and the Release code for Release X+1. If the CR is approved at TSG level, this will automatically create the first instance of the next Release of the spec.
2. Make a specific request to the TSG to upgrade the latest version of the spec from Release X to Release X+1. This might be needed if the functionalities of the two Releases diverge, though backwards-incompatibility is to be avoided if possible.
3. Do nothing. If a spec has survived unchanged throughout the period during which Release X+1 was developed, when Release X+1 is frozen, all such specs will automatically be upgraded from Release X to Release X+1 without technical change.

Where can the rules, protocols or software needed to develop applications for UMTS be found?

A good place to start is on the 3GPP website, and particularly the specifications list.

What is the correlation between Stage 1, Stage 2 and Stage 3?

A three-stage methodology as defined in ITU T Recommendation I.130 is applied in 3GPP according TR 21.900 clause 4.1:

Stage 1 is an overall service description from the user's standpoint.
Stage 2 is an overall description of the organization of the network functions to map service requirements into network capabilities.
Stage 3 is the definition of switching and signalling capabilities needed to support services defined in stage 1.

Are the 3GPP specifications produced only in word?

The 3GPP specs are published as ETSI deliverables, and these are available in PDF form http://www.etsi.org/standards-search. But you can download a free Word viewer (i.e. read only) from the Microsoft web site. PDF is inherently secure (more so than html, in fact), and because WordViewer is very simple (it can not handle macros, for example), it is pretty safe too. ETSI has no plans at present to publish specifications in plain text or in html.

Which group works with specifications covering the use of the GSM codec (either in C or Java based)?

The SMG STC SMG11 and 3GPP SA4 specifications, available from http://www.3gpp.org, respectively deal with this. It gives you a list of specifications via the status list (look for the GSM specs in the MS-Access database at : http://www.3gpp.org/ftp/Information/Databases/Spec_Status/)

and you can then download the specs you need. If you do not have an ETSI EOL account, you can download the ETSI equivalent standards from http://www.etsi.org/standards-search.

Where can I find documents produced by the GSM MoU Group / GSM Association?

These documents are not available via 3GPP or its Organizational Partners. You must address this question to the GSM Association.

Where would I find a document (e.g. UMTS 30.03 version 3.1.0) which does not appear on the 3GPP Status List?

Look at http://www.3gpp.org/DynaReport/3003U.htm. It is a document stemming from the initial TC-SMG studies on UMTS, not a product of 3GPP. It was, in fact, published as an ETSI deliverable, TR 101 112, and this may be downloaded via http://www.etsi.org/standards-search.

Where are all the Change Requests (CRs) located?

The CR database can be downloaded under: http://www.3gpp.org/ftp/Information/Databases/Change_Request/

Or you select the specification under:
http://www.3gpp.org/specifications/79-specification-numbering

The information is classed by series so it is very easy to locate the particular specification which interests you. After selecting a series and a specification you will find a line "Change Requests for this spec: click here." which provides a web list of the CRs for this specification.

If, for example, you are looking for CRs on GSM 08.18 then you would use this link:
http://www.3gpp.org/ftp/Specs/html-info/0818-CRs.htm
http://www.3gpp.org/DynaReport/0818-CRs.htm

Where are all the current ETSI SMG specs located?

All the ETSI SMG specs are located here archives for the GSM documentation. An ETSI On-Line account is needed to access these documents. You can apply for an ETSI online account.
In general, the cross-referencing between GSM and ETSI deliverables, and between 3GPP and ETSI deliverables may be found at http://webapp.etsi.org/key/queryform.asp

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Which group works on Physical Layer aspects of UMTS/LTE?

The radio aspects are standardised in TSG-RAN. The technical work is done in the 5 Working Groups of RAN (WG1 radio layer 1, WG2 radio layer 2/3, WG3 interfaces, WG4 RF measurements, WG5 Mobile Terminal Conformance Testing).
So Physical Layer aspects are addressed by TSG RAN WG1. Their UMTS specifications are numbered 25.2xx and their LTE specifications are numbered 36.2xx.
The temporary documents (meeting documents etc.) of WG1 are stored on ftp://ftp.3gpp.org/TSG_RAN/WG1_RL1.

Where can I find the list of Abstract syntax notation (ASN.1) object identifiers?

The expandable list of object identifiers is available here >>>. To see the formal definition of the object identifiers, see the document cited on the right. The tree is not necessarily complete; further extensions may be included in the referenced document. For more information look here >>>.

Where can I find the 3GPP Confidentiality and Integrity algorithms?

The 3GPP Confidentiality and Integrity algorithms F8 & F9 (KASUMI) have been developed through the collaborative efforts of the 3GPP Organizational Partners. For more information and in order to download the algorithms look here >>>.

What is a Release - how does specification version numbering work?

To meet new market requirements, 3GPP specifications are continually being enhanced with new features. In order to provide developers with a stable platform for implementation while at the same time allowing the addition of new features, the 3GPP uses a system of parallel "releases". For more information look here >>>.

Where can I find information on the current status of 3GPP specifications?

New versions of many 3GPP specifications are made available shortly after the 3GPP TSG plenary meetings which take place four times a year (March, June, September and December). In order to identify what the current version is or and how to find information about older versions of specifications look here >>>.

What is the system for numbering specifications?

All 3G and GSM specifications have a 3GPP specification number consisting of 4 or 5 digits. (e.g., 09.02 or 29.002). For a more complete description and examples look here >>>.

Who are the TSG/WG Officials and Support team and where can I find their contact details?

Each TSG/WG has a Chairman, up to two Vice-Chairmen (three Vice-Chairmen) in the case of TSGs and a secretary who is a member of the support team. From the 3GPP structural organization page, click on the TSG or WG of interest to reach its home page. From there, click on the "officials" entry in the table.

Where can I find the Terms of Reference for my TSG/WG?

The current Terms of Reference for each TSG/WG appear on the web pages of each TSG/WG.

May I become an Official?

The TSG Chairman and Vice Chairmen are elected by the Technical Specification Group from amongst the Individual Member representatives. Each TSG can elect a maximum of two Vice Chairmen. Once elected, these candidates are proposed to the PCG for appointment.
The Working Group Chairman and Vice Chairmen are elected by the Working Group from amongst the Individual Member representatives. Each Working Group can elect a maximum of two Vice Chairmen.
A candidate for TSG or Working Group election shall provide a letter of support from his Organization and nominations may be made up to the point when an election takes place.
The TSG Chairman and Vice-Chairmen shall be appointed by the PCG on the proposal of the TSG.
The Chairman and the Vice-Chairmen shall be appointed for a two year term of office. The Chairman and Vice-Chairmen may be appointed for one further consecutive term. If, at the end of a Chairman or Vice Chairmans second term, no other candidates are available, the Chairman or Vice Chairmen may be appointed for a further term.
Chairman and Vice Chairmen should not be from the same region, Organizational Partner, or from the same group of companies, unless no other candidate is available.
Successive Chairmen should not be from the same Organizational Partner, the same region or from the same group of companies, unless no other candidate is available

How do I register for a meeting?

Please note that all registration for 3GPP meetings is carried out on-line (i.e. via the 3GPP website). To register for a meeting just follow the simple steps outlined below:
1) Go to the 3GPP on line registration area http://webapp.etsi.org/3GPPRegistration/fMain.asp?mid
2) Scroll to find the meeting you wish to attend
3) Click on the circle to the left of the meeting title (clicking on the title will provide you with the meeting details)
4) Scroll back up to the top of the page
5) Click on the Register button
6) Fill in the details on the next page, choosing your company from the drop down menu and complete with all your coordinates
NB: Companies are classed by partners so ensure that you have registered under the correct partner.
7) Click on Submit registration

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Who can submit a change proposal on any 3GPP specifications to 3GPP?

Any bona fide representative of any 3GPP Individual Member (see list via the first sentence at http://www.3gpp.org/membership) can present a technical contribution - for example, a Change Request - to any 3GPP TSG or WG meeting.

If a change proposal is submitted how long does it take for it to get approved?

The usual procedure is that the responsible Working Group will examine a CR and agree it (or revise it until such time as it be agreeable - or not!). Having been agreed at WG level, it is packaged with related CRs and sent to the TSG plenary, where it will be discussed if necessary and then - if appropriate - formally approved. Within a matter a few weeks at most, a new version of the Specification is produced, which includes the contents of the TSG-approved CR.

TSGs meet every three months, and WGs meet at least once between each TSG meeting (sometimes two or occasionally even more times). Thus from inception of a CR to its approval is normally a matter of a few weeks, depending on the point in the meeting schedule of the WG and TSG concerned.

How to get a user name and password for "Reserve a Document Number"?

You need to request an EOL account via: http://webapp.etsi.org/createaccount/form.asp (username and password will then be sent to you by separate email).

How do I obtain a document number for my contribution?

Delegates wishing to make contributions must first obtain a document number either from the secretary or automatically via an on-line application "Automatic Document Numbering (ADN)" which is used by some groups.

You need a user name and password to "Reserve a Document Number" (see above).

Where can I download documents for an upcoming meeting?

Each TSG/WG has a specific area allocated on the 3GPP ftp server. For example TSG SA look here ftp://ftp.3gpp.org/tsg_sa/TSG_SA/. It is advisable for delegates attending a meeting to download the documents available prior to the meeting from the ftp server and onto their personal computers.

Where can I find a temporary document template?

The document template is made available by each TSG/WG in the meeting respective folder on the ftp server (see above).

What is my role when my TSG/WGs has to approve a deliverable?

Approval of Technical Specifications and Technical reports by a TSG shall normally be by consensus. Where consensus cannot be achieved in the TSG a vote may be taken.
When Technical Specifications and Technical Reports become sufficiently stable, they shall be put under change control of the relevant TSG. The further elaboration of these Technical Specifications and Technical Reports shall be achieved by Change Requests (CRs) to be approved by the TSG.

What are the different types of deliverables?

3GPP shall prepare, approve and maintain documents known as Technical Specifications and Technical Reports. Such documents shall be drawn up by the TSGs and shall, following approval at that level, be submitted to the participating Organizational Partners to be submitted to their respective standardization processes.

Can I write an 3GPP Document myself?

Why not?! If you wish to propose a deliverable then bring it to the attention of your chairman and the other members of the TSG/WG in order to discuss the subject.
Each proposed new Work Item shall be supported by at least four Individual Members, and their names shall be recorded in the Work Item definition prepared for the TSG approval. One or more persons shall be named as Rapporteur for the proposed Work Item, and the Rapporteur shall act as the prime contact point on technical matters and for information on progress throughout the drafting phases. The supporting Individual Members are expected to contribute to and progress the new work item throughout the drafting phases.
In addition to the above, TSGs shall approve new Work Items, giving all essential parameters. The proposal shall be entered into the 3GPP work programme, clearly marked as a new entry, for which a unique reference identity shall be allocated.

Do I and my company have to support my TSG/WGs Work Items?

Neither you or your company is obliged to support the work items of your TSG/WG, however it is normal that if you and your company are supporting members of a Work Item that you be in agreement with their work and will normally support the production of the related deliverable.

Do I need a password and user name to access the 3GPP Web site ?

No password is needed to access any information on the 3GPP Web site, all information is openly published.

Can you give me information about which companies manufacture particular types of equipment. Or about what services are available on particular

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networks?

No. The 3GPP Support Team must remain neutral and must not show bias to any of its Individual Members. Such information may be available from the Global Mobile Suppliers Association (www.gsacom.com) where you will find a statistics area which could be of help.

How can I determine when a meeting contribution document (TDoc) became publicly available?

TDoc numbers start to be allocated some weeks before a 3GPP meeting, and the authors then create them and they or the group's secretary uploads them to the public file server as soon as possible. Some may have been distributed to the group's members in draft form for review, using the email exploder, in advance of the final one becoming available, and for some groups, it is normal to distribute even the final TDoc via the exploder, where the secretary picks it up and copies it to the public server. Typically, at the start of a meeting, around 50% of the TDocs are available.

This distribution on the group's email exploder is important, because once that happens, the document is effectively in the public domain, since membership of the exploder is open to all and is unpoliced.

During the meeting, further TDocs are created, mostly revisions of ones available before the meeting, but probably some brand new ones too – for example, outgoing liaison statements. These are uploaded to the meeting server, but (until recently) may or may not be uploaded to the public server during the meeting. (Since 2014, for most meetings, meeting server contents have been mirrored to a folder on the public server, but these copies are deleted shortly after the end of the meeting.)

Soon after the end of the meeting – same day, or at worst within a few days – the TDocs created during the meeting are uploaded by the secretary to the public server. Occasionally, some matters from the meeting cannot be resolved until maybe one week later, and these might result in some very late TDocs which are produced well after the end of the meeting, and thus uploaded onto the public server correspondingly late.

When the secretary copies from the meeting server (or from his own PC) to the public server, he may opt to only copy the missing files (i.e. the new ones), which is the best approach; or he may decide to overwrite everything and thus do a complete refresh of the files on the public server, which will now get an upload date/time-stamp of the new upload. This latter approach is now deprecated but has sometimes happened; you can detect this most easily when a meeting shows the same date/time-stamp for all TDoc files.

In cases such as this, one has to descend to greater subterfuge to narrow down the likely "public availability" moment. The zip file for a TDoc typically contains a Word file which has a particular date/time-stamp, which puts an absolute limit on the earliest moment that the TDoc could have become available in that form.

Searching the group's email exploder archive (http://list.etsi.org/scripts/wa.exe?INDEX) on or about the suspected production date gleaned from the file date/time-stamp may well reveal the message in which the TDoc was first distributed, or perhaps the message by which the group's secretary announced that it was available on the server. Note however that this technique does not reveal any earlier versions of the TDoc which might have been circulated, either as draft versions of the identified TDoc or as other Tdocs which were ultimately revised into the actual TDoc of interest. In order to identify this latter case, it is necessary to refer to the official secretary's report of the meeting, where the train of revisions will be evident.

Is it possible to determine the date and time of publication of a particular version of a 3GPP Spec?

During the drafting phase (versions lower than 3.0.0), 3GPP TSs and TRs ("Specs") are under the control of their authors ("rapporteurs") and are handled like normal meeting contributions (see above). Revised versions incorporating text agreed by the responsible working group are often made available by the rapporteur via the group's email exploder shortly after the end of the meeting at which such text was discussed. Again, consultation of the exploder archives can reveal this. Alternatively, a revised draft may be sent directly to the 3GPP Support Team, and it will be uploaded to the public file server (specs archive directory) shortly afterwards. Again, the time stamp of the Zip file can be relied upon to indicate when the upload occurred.

After formal approval by the TSG (versions 3.0.0 or greater), Specs are edited only by the Support Team. The first approved version is based upon the draft version formally approved by the TSG, and thereafter versions are generated whenever Change Requests are approved by the TSG. These versions are made available shortly after the TSG meeting at which such approval occurred. The date (year and month) shown at the top of the Spec's cover page indicates either the date of (the last day of) the meeting, or the month in which the new version was prepared. However a more precise indication of the date of availability can be obtained from the Spec's web page (via the table at http://www.3gpp.org/specifications/) where a precise date is shown in the "available" column.

More information on the procedures relating to Spec handing can be found in 3GPP TR 21.900.

Note that, in accordance with the statement at the foot of the cover page of all 3GPP Specs, 3GPP does not "publish" its Specs per se. Formal publication is the responsibility of the individual Standards Development Organizations which comprise the Organizational Partners of 3GPP. For further information, see http://www.3gpp.org/specifications/63-official-publications.

What formalities do I have to go through to get type approval for terminal equipment in Europe? Is there a single point of contact? What standards does my equipment need to conform to in order that I can place it on the market?

The legal requirements for the marketing of electrical products in Europe are governed by various EU Directives, depending on the nature of the equipment. Conformity with any of these Directives can be demonstrated by the use of Harmonized Standards,

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whose title has been cited in the Official Journal of the European Union. The lists of relevant standards can be found on the Commission web site which can be accessed via http://www.newapproach.org/Directives/DirectiveList.asp.

General electrical equipment is covered by the EMC Directive & Low Voltage Directives, see http://ec.europa.eu/enterprise/sectors/electrical/documents/index_en.htm.
The harmonized standards are listed at http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/index_en.htm
More general information on procedures to declare conformity and how equipment should be marked are contained on the web sites related to the two Directives.

Radio Equipment and Telecommunications Terminal Equipment is covered by the Radio and Telecommunications Terminal Equipment Directive, see http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/rtte/index_en.htm, which also includes a link to the one-stop procedure for "placing on the market" (http://ec.europa.eu/enterprise/sectors/rtte/documents/guidance/one-stop-procedure_en.htm).

Further information on EU harmonized standards relevant to telecommunications can be found on the ETSI site at http://www.etsi.org/standards/looking-for-an-etsi-standard/list-of-harmonized-standards, and the published standards themselves can be downloaded via http://pda.etsi.org/pda/queryform.asp.

Where can I find a list of technical terms and abbreviations used in 3GPP documents?

Individual terms are defined in each 3GPP Technical Specification and Technical Report. A compendium of terms and abbreviations can be found in 3GPP TR 21.905. ETSI maintains a list of all terms and abbreviations defined in its publications in "TEDDI".

What is the difference between a SIM and a USIM? What is a UICC?

The Universal Integrated Circuit Card (UICC) is the removable card bearing a silicon chip which holds 3GPP system subscriber information. The UICC is a general purpose card having both non-volatile memory and a general-purpose processor. Thus while it is used, in a 3GPP terminal, to hold (U)SIM information / applications, it is can also be used for other purposes, possibly unrelated to telecommunications. A common use of UICCs is in the well-known credit card format, and there is no reason why a single card could not hold (U)SIM functionality in addition to electronic purse / credit card functionality, or indeed any other application / data.

The Subscriber Identity Module (SIM) is the collection of functions which personalize a 3GPP terminal. The SIM contains static information about the services subscribed to, the phone number, the identity of the home network, a list of preferred roaming networks, and so on. The SIM also contains storage capacity for the subscriber's contacts' phone numbers. The term "SIM" is often misused for "UICC". The SIM concept was created during the early development of the GSM standards, and second-generation (based on GERAN) terminals up to and including Release 4 use SIM functionality.

For third generation systems (based on UTRAN), more complex functionality was called for, and the SIM evolved into the USIM or Universal Subscriber Identity Module. Release 99 3rd generations onwards use USIMs rather than SIMs. From Release 5 onwards, both second and third generation terminals use USIMs (though to maintain backwards compatibility with older networks and terminals, later Release 2nd generation USIMs are likely to implement Rel-4 SIM functionality in addition to Rel-5 or later USIM functionality).

For further information on the 3GPP Release system, see the Release page.

I have transferred a video file from my phone to my PC. Where can I find a player for 3gp files?

The 3gp file format is defined in 3GPP TS 26.244 and in 3GPP TS 26.412. However, 3GPP has not defined a specific decoder. Your phone manufacturer may have supplied a player (check the CD-ROM which came with your phone) or look on its web site. Alternatively, search the Internet: a number of commercial players exist, and trial versions of some may be downloaded without charge.

Where can I find the specification of the SIM Lock feature?

In clause 8 of 3GPP TS 22.022.

What is the meaning of the text at the foot of the TS/TR cover page?

> The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP..
> The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented.
> This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification.
> Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

3GPP is not a legally incorporated body, and its technical work is conducted under the auspices of its Organizational Partners, each of which transposes relevant 3GPP specifications as its own publications. Thus the "raw" 3GPP TSs and TRs have no legal status per se. Under an agreement with the ITU at the time 3GPP was created, the ITU would not publish the output of

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3GPP but would normatively reference the publications of the participating Organizational Partners; this state of affairs accounts for the text found on the cover of each 3GPP TS and TR. More information can be found here.

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GERAN	**71**	**Goteborg**	22-26 Aug 2016
CT	**73**	**New Orleans**	19-20 Sep 2016
RAN	**73**	**New Orleans**	19-22 Sep 2016
SA	**73**	**New Orleans**	21-23 Sep 2016
GERAN	**72**	**US**	14-18 Nov 2016
CT	**74**	**Vienna**	05-06 Dec 2016
RAN	**74**	**Vienna**	05-08 Dec 2016
SA	**74**	**Vienna**	07-09 Dec 2016
GERAN	**73**	**EU**	13-17 Feb 2017
CT	**75**	**Dubrovnik**	06-07 Mar 2017
RAN	**75**	**Dubrovnik**	06-09 Mar 2017
SA	**75**	**Dubrovnik**	08-10 Mar 2017
GERAN	**74**		15-19 May 2017
CT	**76**	**US**	05-06 Jun 2017
RAN	**76**	**US**	05-08 Jun 2017
SA	**76**	**US**	07-09 Jun 2017

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Release 12
Release 11
Release 10
Release 9
Release 8
Release 7
Release 6
Release 5
Release 4
Release 1999

BROWSE TECHNOLOGIES

LTE-Advanced
LTE
Carrier Aggregation Explained
HetNet/Small Cells
NAS
The Evolved Packet Core
HSPA
UMTS
W-CDMA
GPRS & EDGE

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APPENDIX 11

The Wayback Machine - https://web.archive.org/web/20160714151747/http://www.3gpp.org:80/specifications/specifications



Specifications Home

3GPP specifications are published - free of charge - up to four times a year following the quarterly Technical Specification Group (TSG) plenary meetings. At each TSG round, specs can be

- Newly brought under change control (i.e. at least 80% complete)
- Unchanged from their previous versions
- Revised as a result of incorporating approved Change Requests (either in existing Releases or in the latest Release)
- At Release-freeze time, upgraded to that Release with no technical change

The 3GPP Mobile Competence Centre (MCC) aims to make all Specs available following a TSG round as soon as possible. The target dates are shown in the table below. Where very many CRs have to be implemented, or very many specifications are to be produced, a further week beyond the above deadlines may be required. These dates are agreed by the TSG Chairmen. Over the Christmas and New Year period, when the winter TSG round finishes shortly before the holiday period, an extra week or so is normally added to the final deadlines.

Quick link to the specifications file server area

The link above takes you straight to the specifications, but you need to know what you are looking for.

To find a particular specification by series, look at the Numbering page.

3GPP specifications

The term "3GPP specification" covers all GSM (including GPRS and EDGE), W-CDMA (including HSPA) and LTE (including LTE-Advanced) specifications. The following terms are also used to describe networks using the 3G specifications: UTRAN, UMTS (in Europe) and FOMA (in Japan).

Revised versions of many of these specifications are produced up to four times a year following the quarterly TSG plenary meetings.

The table below leads to information about:

- Specifications arising from each plenary TSG meeting, including the latest versions of each specification that was not changed at that meeting. i.e. each directory holds a complete set of specifications.
- The month of the meeting and the meeting number
- The Status List (ZIPped RTF or Word format) summarizing the current version number for every release of every 3GPP specification following each TSG plenary meeting.
- Details of each specification (working group, rapporteur, the Project Manager in MCC (Mobile Competence Centre), the meeting at which it was, or is expected to be, "frozen" (i.e. the point after which only corrections are allowed) - all are in the Status lists.

Full details of the Specifications, their history and current status can be found in the 3GPP Specifications Status database.

See this link for specs awaited from the most recent Plenary meetings.

year-month	remark click here to see list of specs still awaited from current plenary round	latest status	specs directory	TSG CN #	TSG RAN* #	TSG T #	TSG SA #	TSG GERAN #	TSG CT #
2016-06		StatusList	2016-06		72		72	70	72
2016-03		StatusList	2016-03		71		71	69	71
2015-12		StatusList	2015-12		70		70	68	70
2015-09		StatusList	2015-09		69		69	67	69
2015-06		StatusList	2015-06		68		68	66	68

Search

3GPP Website: Search for...

Search and download specs, docs, CRs and more from the 3GPP FTP Server:

ADVANCED FTP SEARCH

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year-month	remark click here to see list of specs still awaited from current plenary round	latest status	specs directory	TSG CN #	TSG RAN* #	TSG T #	TSG SA #	TSG GERAN #	TSG CT #
2015-03		StatusList	2015-03		67		67	65	67
2014-12		StatusList	2014-12		66		66	64	66
2014-09		StatusList	2014-09		65		65	63	65
2014-06		StatusList	2014-06		64		64	62	64
2014-03		StatusList	2014-03		63		63	61	63
2013-12		StatusList	2013-12		62		62	60	62
2013-09		StatusList	2013-09		61		61	59	61
2013-06		StatusList	2013-06		60		60	58	60
2013-03		StatusList	2013-03		59		59	57	59
2012-12		StatusList	2012-12		58		58	56	58
2012-09		StatusList	2012-09		57		57	55	57
2012-06		StatusList	2012-06		56		56	54	56
2012-03		StatusList	2012-03		55		55	53	55
2011-12		StatusList	2011-12		54		54	52	54
2011-09		StatusList	2011-09		53		53	51	53
2011-06		StatusList	2011-06		52		52	50	52
2011-03		StatusList	2011-03		51		51	49	51
2010-12		StatusList	2010-12		50		50	48	50
2010-09		StatusList	2010-09		49		49	47	49
2010-06		StatusList	2010-06		48		48	46	48
2010-03		StatusList	2010-03		47		47	45	47
2009-12		StatusList	2009-12		46		46	44	46
2009-09		StatusList	2009-09		45		45	43	45
2009-06		StatusList	2009-06		44		44	42	44
2009-03		StatusList	2009-03		43		43	41	43
2008-12		StatusList	2008-12		42		42	40	42
2008-09		StatusList	2008-09		41		41	39	41
2008-06		StatusList	2008-06		40		40	38	40

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year-month	remark click here to see list of specs still awaited from current plenary round	latest status	specs directory	TSG CN #	TSG RAN* #	TSG T #	TSG SA #	TSG GERAN #	TSG CT #
2008-03		StatusList	2008-03		39		39	37	39
2007-12		StatusList	2007-12		38		38	36	38
2007-09		StatusList	2007-09		37		37	35	37
2007-06		StatusList	2007-06		36		36	34	36
2007-03		StatusList	2007-03		35		35	33	35
2006-12		StatusList	2006-12		34		34	32	34
2006-09	GERAN henceforward meets synchronously with other TSGs, so no further "delta" directories necessary.	StatusList	2006-09		33		33	31	33
2006-06	New at GERAN only.		2006-06					30	
2006-06		StatusList	2006-06		32		32		32
2006-04	New at GERAN only.		2006-04					29	
2006-03		StatusList	2006-03		31		31		31
2006-01	New at GERAN only.		2006-01					28	
2005-12		StatusList	2005-12		30		30		30
2005-11	New at GERAN only.		2005-11					27	
2005-09		StatusList	2005-09		29		29		29
2005-08/09	New at GERAN only.		2005-09					26	
2005-06	New at GERAN only.		2005-06					25	
2005-06		StatusList	2005-06		28		28		28
2005-04	New at GERAN only.		2005-04					24	
2005-03	RAN closed and RANnew opened, CN and T closed, CT opened.	StatusList	2005-03	27	27bis, 27	27	27		27
2005-01	New at GERAN only.		2005-01					23	
2004-12		StatusList	2004-12	26	26	26	26		
2004-11	New at GERAN only.		2004-11					22	
2004-09		StatusList	2004-09	25	25	25	25		
2004-08	New at GERAN only.		2004-08					21	
2004-06	New at GERAN only.		2004-06					20	
2004-06		StatusList	2004-06	24	24	24	24		

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year-month	remark click here to see list of specs still awaited from current plenary round	latest status	specs directory	TSG CN #	TSG RAN* #	TSG T #	TSG SA #	TSG GERAN #	TSG CT #
2004-04	New at GERAN only.		2004-04					19	
2004-03		StatusList	2004-03	23	23	23	23		
2004-02	New at GERAN only.		2004-02					18	
2003-12		StatusList	2003-12	22	22	22	22		
2003-11	New at GERAN only.		2003-11					17	
2003-09		StatusList	2003-09	21	21	21	21		
2003-09	New at GERAN only.		2003-09					16	
2003-06	New at GERAN only.		2003-06					15	
2003-06		StatusList	2003-06	20	20	20	20		
2003-04	New at GERAN only.		2003-04					14	
2003-02		StatusList	2003-03	19	19	19	19		
2003-02	New at GERAN only.		2003-02					13	
2002-12, 2002-11		StatusList	2002-12	18	18	18	18	12	
2002-09		StatusList	2002-09	17	17	17	17	11	
2002-06	Rel-5 GERAN features content functionally frozen		2002-06					10	
2002-06	Rel-5 features content functionally frozen (remainder, non-GERAN)	StatusList	2002-06	16	16	16	16		
2002-04			2002-04					9	
2002-03	Rel-5 features content functionally frozen (part)	StatusList	2002-03	15	15	15	15		
2002-02								8	
2001-12		StatusList	2001-12	14	14	14	14		
2001-11								7	
2001-09		StatusList	2001-09	13	13	13	13		
2001-08								6	
2001-06		StatusList	2001-06	12	12	12	12	5	
2001-06	Rel-4 GERAN features content functionally frozen							4	
2001-03	Rel-4 non-GERAN features content functionally frozen	StatusList	2001-03	11	11	11	11		
2001-01								3	

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year-month	remark click here to see list of specs still awaited from current plenary round	latest status	specs directory	TSG CN #	TSG RAN* #	TSG T #	TSG SA #	TSG GERAN #	TSG CT #
2000-12, 2000-11		StatusList	2000-12	10	10	10	10	2	
2000-11									
2000-09		StatusList	2000-09	9	9	9	9	1	
2000-06		StatusList	2000-06	8	8	8	8		
2000-03				7	7	7	7		
1999-12	R99 features content functionally frozen			6	6	6	6		
1999-10				5	5	5	5		
1999-06					4	4	4		
1999-05				4					
1999-04				3	3	3	3		
1999-03				2	2	2	2		
1998-12				1	1	1	1		

** TSG RAN was closed at the end of meeting 27 and re-opened for meeting 27 bis.*

If you plan to download a large number of specifications we recommend using an FTP client software tool such as:

- Ipswitch WS_FTP Pro
- FTPSync
- Filezilla

For additional information relating to 3GPP Specifications, their creation and maintenance, etc. go here.

Confidential Algorithms

3GPP confidentiality and integrity algorithms The 3GPP Confidentiality and Integrity algorithms F8 & F9 (KASUMI) have been developed through the collaborative efforts of the 3GPP Organizational Partners. They may be used only for the development and operation of 3G Mobile Communications and services. Every Beneficiary must sign a Restricted Usage Undertaking with a Custodian and (...)
more »

ASN.1

ASN.1 Object Identifiers Abstract syntax notation (ASN.1) object identifiers maintained by ETSI. ETSI is a recognized organization under the ITU-T (formerly CCITT) arc. The formal rules governing assignment of object identifier values are given in ETSI EG 200 351. Since the 3GPP technical specifications are based on GSM specifications, which use object identifiers under the ETSI node, it (...)
more »

Drafting Rules

The Specification drafting rulesTR 21.801 are the rules for the structure and drafting of documents intended to become a 3GPP Technical Specification or Technical Report. These rules are intended to ensure that such documents are drafted in as uniform a manner as is practicable, irrespective of the technical content. 21.801 is based on the ISO/IEC Directives, Part 3, but is a self-contained (...)
more »

Official Publications

The 3GPP Technical Specifications and Technical Reports have, in themselves, no legal standing. They only become "official" when transposed into corresponding publications of the Partner Organizations (or the national / regional standards body acting as publisher for the Partner). At this point, the specifications are referred to as UMTS within ETSI and FOMA within ARIB/TTC. Some TRs (...)
more »

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Page reviewed and updated 2014-03-27, John M Meredith

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CT	**73**	**New Orleans**	19-20 Sep 2016
RAN	**73**	**New Orleans**	19-22 Sep 2016
SA	**73**	**New Orleans**	21-23 Sep 2016
GERAN	**72**	**US**	14-18 Nov 2016
CT	**74**	**Vienna**	05-06 Dec 2016
RAN	**74**	**Vienna**	05-08 Dec 2016
SA	**74**	**Vienna**	07-09 Dec 2016
GERAN	**73**	**EU**	13-17 Feb 2017
CT	**75**	**Dubrovnik**	06-07 Mar 2017
RAN	**75**	**Dubrovnik**	06-09 Mar 2017
SA	**75**	**Dubrovnik**	08-10 Mar 2017
GERAN	**74**		15-19 May 2017
CT	**76**	**US**	05-06 Jun 2017
RAN	**76**	**US**	05-08 Jun 2017
SA	**76**	**US**	07-09 Jun 2017

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BROWSE TECHNOLOGIES

LTE-Advanced
LTE
Carrier Aggregation Explained
HetNet/Small Cells
NAS
The Evolved Packet Core
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APPENDIX 12

The Wayback Machine - https://web.archive.org/web/20160703090241/http://3gpp.org:80/specifications/79-specification-numbering

Specification Numbering

All 3GPP specifications have a specification number consisting of 4 or 5 digits. (e.g. 09.02 or 29.002).

The first two digits define the series, followed by 2 further digits for the 01 to 13 series or 3 further digits for the 21 to 55 series.

The full title, specification number and latest version number for every specification can be found in the current status list (warning: large file!).

An automated list of Specification numbers - with the Title and details of the Specification Group responsible.

Subject of specification series	3G and beyond / GSM (R99 and later)	GSM only (Rel-4 and later)	GSM only (before Rel-4)
General information (long defunct)			00 series
Requirements	21 series	41 series	01 series
Service aspects ("stage 1")	22 series	42 series	02 series
Technical realization ("stage 2")	23 series	43 series	03 series
Signalling protocols ("stage 3") - user equipment to network	24 series	44 series	04 series
Radio aspects	25 series	45 series	05 series
CODECs	26 series	46 series	06 series
Data	27 series	47 series (none exists)	07 series
Signalling protocols ("stage 3") -(RSS-CN) and OAM&P and Charging (overflow from 32.- range)	28 series	48 series	08 series
Signalling protocols ("stage 3") - intra-fixed-network	29 series	49 series	09 series
Programme management	30 series	50 series	10 series
Subscriber Identity Module (SIM / USIM), IC Cards. Test specs.	31 series	51 series	11 series
OAM&P and Charging	32 series	52 series	12 series
Access requirements and test specifications		13 series (1)	13 series (1)
Security aspects	33 series	(2)	(2)
UE and (U)SIM test specifications	34 series	(2)	11 series
Security algorithms (3)	35 series	55 series	(4)
LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology	36 series	-	-
Multiple radio access technology aspects	37 series	-	-
Radio technology beyond LTE	38 series	-	-

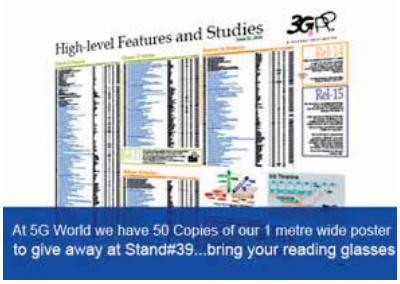
Note (1): The 13 series GSM specifications relate to European-Union-specific regulatory standards. On the closure of ETSI TC SMG, responsibility for these specifications was transferred to ETSI TC MSG, (Mobile Specification Group) and they do not appear on the 3GPP file server.

Note (2): The specifications of these aspects are spread throughout several series.

Note (3): Algorithms may be subject to export licensing conditions. See the relevant 3GPP page. See also the relevant ETSI pages.

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Note (4): The original GSM algorithms are not published and are controlled by the GSM Association.

Technical Reports are of two classes:

> Those intended to be transposed and issued by the Organizational Partners as their own publications; and
>
> Those not intended for publication but which are simply 3GPP internal working documents, used, for example, for documenting planning and scheduling of work, or for holding the interim results of feasibility studies.

The first category have numbers of the form: xx.9xx

The second category have numbers of the form:
xx.8xx (feasibility study reports, etc) or, more rarely,
30.xxx / 50.xxx (planning and scheduling)
For some spec series, the stock of xx.8xx TRs has been exhausted, and in these cases, further internal TRs are allocated xx.7xx numbers.

Missing Specs: Click here to see those Specs not yet available following the most recent round of TSG meetings.

The 3GPP Specifications are stored on the file server as zipped MS-Word files. The filenames have the following structure:

SM[-P[-Q]]-V.zip

where the character fields have the following significance ...

S = series number - 2 characters (see the table above)
M = mantissa (the part of the spec number after the series number) - 2 or 3 characters (see above)
P = optional part number - 1 or 2 digits if present
Q = optional sub-part number - 1 or 2 digits if present
V = version number, without separating dots - 3 digits

So for example:

> 21900-320.zip is 3GPP TR 21.900 version 3.2.0
> 0408-6g0.zip is 3GPP TS 04.08 version 6.16.0
> 32111-4-410 is 3GPP TS 32.111 part 4 version 4.1.0
> 29998-04-1-100 is 3GPP TS 29.998 part 4 sub-part 1 version 1.0.0

Further information:

Latest version
The latest versions of the approved specifications in the "latest" directory. The latest version of draft specs (i.e. those not yet under change control) are in the "latest-drafts" directory. See also the page on version numbering.

Particular version
All older versions of specifications (where available) are stored in the archive subdirectory. All versions of all releases of a given specification are placed directly under the name of the specification.

Title or subject
If you only know the title or the subject, but not the specification number, the best place to start looking is the complete list of all 3GPP specification numbers and titles. This list also shows the most recent version in each Release.

Specs related to a particular working group
Each 3GPP TSG Working Group has a home page, which lists the specifications under its responsibility. Follow the links from here, or use the main menu item "Specification Groups".

Official versions published by recognized Standards Development Organizations
The 3GPP Technical Specifications (and Technical Reports) which are publicly available from this site have, in themselves, no legal standing. They only become "official" when transposed into corresponding publications of the Partner Organizations. If you are looking for the official versions, see the official publications page.

Yet more information:

Work plan
The 3GPP Work plan describes the new functionality currently being elaborated in the TSG working groups. It also indicates the expected timescales for their finalization.

Releases (and phases, stages)
An introduction to the 3GPP mechanism for specifications releases can be found here.

Historical information
If you need to look for old / superseded specifications or change requests, start here.

TSG working methods
The procedures for creating, enhancing and maintaining specifications are described in TR 21.900. A presentation outlining the release and change request process can be found here.

3GPP Drafting rules
The rules for drafting specifications are described in TR 21.801.

Change Requests
The change request mechanism is used when a correction or new functionality is required for an existing specification.

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Version numbering
More information on the version numbering page.

Issuing new TS/TR numbers. More information on this page.

Page updated:

2016-01-12: Mention of TRs numbered xx.7xx as overflow of xx.8xx allocations (JMM)
2015-10-01: Fix broken link to specification groups (JMM)

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SA	**73**	**New Orleans**	21-23 Sep 2016
GERAN	**72**	**US**	14-18 Nov 2016
CT	**74**	**Vienna**	05-06 Dec 2016
RAN	**74**	**Vienna**	05-08 Dec 2016
SA	**74**	**Vienna**	07-09 Dec 2016
GERAN	**73**	**EU**	13-17 Feb 2017
CT	**75**	**Dubrovnik**	06-07 Mar 2017
RAN	**75**	**Dubrovnik**	06-09 Mar 2017
SA	**75**	**Dubrovnik**	08-10 Mar 2017
GERAN	**74**		15-19 May 2017
CT	**76**	**US**	05-06 Jun 2017
RAN	**76**	**US**	05-08 Jun 2017
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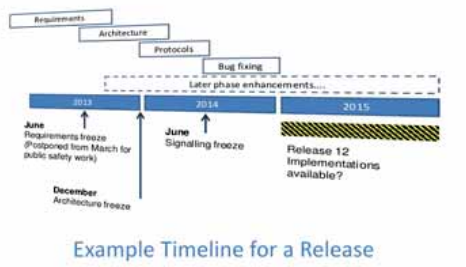
APPENDIX 13

The Wayback Machine - https://web.archive.org/web/20160714070559/http://www.3gpp.org:80/specifications/releases

Releases

3GPP uses a system of parallel "Releases" which provide developers with a stable platform for the implementation of features at a given point and then allow for the addition of new functionality in subsequent Releases. You can learn more about 3GPP Releases by looking in to the following resources:

- A brief description of each Release can be found in the footer of this page, in the 'About Releases' section.
- Full details of the specifications needed for each 3GPP Release can be found in the "Release Description" folder of the ftp site.
- A table of the features, by Release, can also be found in the 3GPP Work Plan.
- There is also a 3GPP Specification Release version matrix which is a listing (with links) of the Specifications - showing the Release in which each specification was first developed.



Example Timeline for a Release

Start, Freeze and End dates:

The table below is extracted from the data on the 3GPP Ultimate portal at https://portal.3gpp.org/ "Releases" tab. Please refer to that data for the most up-to-date information.

Future dates are proposals, subject to change.

Name	Status [Note 3]	Start date [Note 2a]	End date	Closure date
Release 14	Open	2014-09-17	2017-06-09 (SA#76)	
Release 13	Open	2012-09-30	2016-03-11 (SP-71)	
Release 12	Frozen	2011-06-26	2015-03-13 (SP-67)	
Release 11	Frozen	2010-01-22	2013-03-06 (SP-59)	
Release 10	Frozen	2009-01-20	2011-06-08 (SP-52)	
Release 9	Frozen	2008-03-06	2010-03-25 (SP-47)	
Release 8	Frozen	2006-01-23	2009-03-12 (SP-43)	
Release 7	Closed	2003-10-06	2008-03-13 (SP-39)	2014-09-17 (SP-65)
Release 6	Closed	2000-03-28	2005-09-28 (SP-29)	2014-09-17 (SP-65)
Release 5	Closed	2000-05-01 [Note 2a]	2002-09-12 (SP-17)	2014-09-17 (SP-65)
Release 4	Closed	1998-08-01	2001-06-21 (SP-12)	2014-09-17 (SP-65)

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Release 2000 [Note 1]	Closed	1999-03-30 [Note 2a]		1999-12-17 (SP-06)
Release 1999	Closed	1996-11-01	1999-12-17 (SP-06)	2008-06-05 (SP-40)
UMTS	Closed	1994-08-18	1999-02-12 (SMG-28)	2005-06-08 (SP-28)
Release 1998	Closed	1996-03-26	1999-02-12 (SMG-28)	2005-06-08 (SP-28)
Release 1997	Closed	1996-04-15 [Note 2a]		2005-06-08 (SP-28)
Release 96 / Phase 2+	Closed	1995-07-20		2004-09-16 (SP-25)
Phase 2	Closed	1993-03-25		2004-09-16 (SP-25)
Phase 1 extension	Closed	1994-10-01		
Phase 1 DCS-1800	Closed	1992-12-03		
Phase 1	Closed	1987-01-01		

GSM Phases and Version numbers

GSM Release	**TS/TR version [Note 2, 4]**	**3GPP Release**	**TS/TR version**
GSM Phase 1	3.x.y		
GSM Phase 2	4.x.y		
GSM Phase 2+	5.x.y		
GSM Phase 2+ Release 97	6.x.y		
GSM Phase 2+ Release 98	7.x.y		
GSM Phase 2+ Release 99	8.x.y	UMTS Release 99	3.x.y
GSM Phase 2+ Release 00	*9.x.y*		

3GPP Releases and Version numbers

Release	**TS/TR version**
Release 4	4.x.y
Release 5	5.x.y
Release 6	6.x.y
...	
Release 14	12.x.y
...	

Other associated terms

Stages

The term "Stage" derives from the ITU-T (originally CCITT) method for categorizing specifications (Recommendation I.130).

"Stage 1" refers to the service description from a service-user's point of view.

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"Stage 2" is a logical analysis, devising an abstract architecture of functional elements and the information flows amongst them across reference points between functional entities.
"Stage 3" is the concrete implementation of the functionality and of the protocols appearing at physical interfaces between physical elements onto which the functional elements have been mapped.

In addition, 3GPP often performs feasibility studies the results of which are made available in Technical Reports (normally 3GPP-internal TRs, numbered xx.8xx, not intended for transposition by the Organizational Partner SDOs). The feasibility study might be considered as a sort of "Stage 0". Furthermore, some Stage 3 specifications require test specifications to be prepared: effectively a "Stage 4".

Phases

This term has two distinct usages within the 3GPP:

in reference to GSM specifications, Phase 1, Phase 2 and Phase 2+ referred to releases of specifications (see table above);
some features within GSM/3G specifications have been enhanced over the years. For example, enhancements to the original CAMEL functionality are referred to as CAMEL phase 2, CAMEL phase 3 and CAMEL phase 4.

Further information

The mechanisms for creating and maintaining specifications are described in TR 21.900. A presentation outlining the release and change request process can be found here.

Note 1: The term "Release 2000" was used only temporarily and was eventually replaced by "Release 4" and "Release 5" (most elements originally in Release 2000 were renamed Release 4, but some were deferred until Release 5).

Note 2: A Specification with a version number of 0.x.y, 1.x.y or 2.x.y indicates that it is a new, draft, specification which has not yet been approved. The anticipated release is normally shown on the cover of the document.

Note 2a: The start date for a Release is an indication of when the first work item for that Release was approved at TSG level. In fact, it is somewhat approximate because often work items started in an earlier Release, but not completed, are "promoted" to the next Release. The end date for a Release is an indication of when the detailed protocols become stable. However, see Note 3 below.

Note 3: After "freezing", a Release can have no further additional functions added. However, detailed protocol specifications (stage 3) may not yet be complete. "Freezing" is applied successively for each of the three stages (see below), with stage 3 normally being frozen one or two TSG meetings earlier than the "end" date. The "end" date shown on the 3GU portal is indicative only, since for each Release, a considerable number of refinements and corrections can be expected for at least two years following this date. In addition, OA&M specs and test specs may lag by some considerable time. A "frozen" Technical Specification is one which can have no further category B or C (new or modified functionality) Change Requests, other than to align earlier stages with later stages. The individual stage freeze dates can only be seen by 3GU account holders (delegates, officials, secretariat).

Note 4: In the version number of a 3GPP TS or TR, the first field (before the first dot) indicates the Release number according to the table below. The field "x" is incremented at each change in the spec resulting from one or more Change Requests approved by the responsible TSG. Field "y" is incremented whenever an editorial change is made to a specification; editorial changes are those which cannot in any way change the technical interpretation of the spec, and are introduced at the discretion of the Support Team. Exceptionally, field "y" is incremented when a newly-provided version of a spec is found to be flawed due to, for example, misimplementation of a newly-approved CR; however, this circumstance is only permitted during the three-week period following the end of a TSG plenary round, during which new versions of specs are produced. Every change of version is documented in the "change history" annex of the spec. When "x" is incremented, field "y" is reset to zero. When the Release field (the first digit) is incremented, fields "x" and "y" are reset to zero. Version numbering was unified from Release 4 onwards, regardless of radio access technology. This implied a renumbering of the GSM-only specifications (see the Specification Numbering page).

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RAN1 - Radio layer 1

NEW: (2016-04-11) As a result of acquisition of Alcatel-Lucent by Nokia please find here the support letter of Nokia for Matthew Baker to continue as Vice Chairman of 3GPP TSG RAN WG1.

RAN WG1 (Radio layer 1) is responsible for the specification of the physical layer of the radio Interface for UE, UTRAN, Evolved UTRAN, and beyond; covering both FDD and TDD modes of the radio interface.

Terms of reference

The latest terms of reference were approved at RAN#53
in document RP-110963.zip.

Within the scope of TSG RAN, RAN WG1 is responsible for the development of specifications dealing with UTRA, Evolved UTRA, and beyond.
RAN WG1 is responsible for:

Specification of the physical layer of the Uu radio Interface for UE, UTRAN, Evolved UTRAN, and beyond, covering both FDD and TDD modes, as well as the physical layer of the Un Interface for Relay Nodes. The work in RAN WG1 includes especially:

Specification of physical channel structures
Specification of the mapping of the transport channels onto physical channels
Specification of the physical layer multiplexing, and channel coding and error detection
Specification of the spreading and modulation
Specification of the physical layer procedures
Specification of definition of measurements and their provision by the physical layer to the upper layers RAN WG1 also carries out work related to handling of the physical layer related UE capabilities and to physical layer related parameters used in UE tests developed in TSG RAN.

Useful links and information

About RAN WG1	List of elected officials
Documents	Documents area
	Specifications
	Work items
Meetings	Next meeting information & previous meeting reports and documents
	Liaisons Statements
	Full RAN WG1 meeting calendar
General info	Email exploder lists

RAN Working groups and Ad Hoc groups	
TSG RAN Plenary	
TSG RAN WG1	Radio Layer 1 specification
TSG RAN WG2	Radio Layer 2 and Radio Layer 3 RR specification
TSG RAN WG3	Iub Iur and Iu specification - UTRAN O&M requirements

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RAN Working groups and Ad Hoc groups	
TSG RAN WG4	Radio performance and protocol aspects (system) - RF parameters and BS conformance
TSG RAN WG5	Mobile terminal conformance testing
TSG RAN WG6	Legacy RAN radio and protocol
TSG RAN AHG1	Ad-hoc group on ITU (internal) co-ordination

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APPENDIX 15

The Mobile Broadband Standard
GPRS

Specifications Groups Home

Click on any TSG or WG - in the chart below - to go to that Group's home page to find information on its elected officials, its meeting schedule, the Work Items and Specifications for which it is responsible, etc.

TSG Structure

Project Co-ordination Group (PCG)			
TSG GERAN GSM EDGE Radio Access Network	**TSG RAN** Radio Access Network	**TSG SA** Service & Systems Aspects	**TSG CT** Core Network & Terminals
GERAN WG1 Radio Aspects	RAN WG1 Radio Layer 1 spec	SA WG1 Services	CT WG1 MM/CC/SM (Iu)
GERAN WG2 Protocol Aspects	RAN WG2 Radio Layer 2 spec Radio Layer 3 RR spec	SA WG2 Architecture	CT WG3 Interworking with external networks
GERAN WG3 Terminal Testing	RAN WG3 Iub spec, Iur spec, Iu spec UTRAN O&M requirements	SA WG3 Security	CT WG4 MAP/GTP/BCH/SS
	RAN WG4 Radio Performance Protocol aspects	SA WG4 Codec	CT WG6 Smart Card Application Aspects
	RAN WG5 Mobile Terminal Conformance Testing	SA WG5 Telecom Management	
	RAN WG6 Legacy RAN radio and protocol	SA WG6 Mission-critical applications	

RAN

3G systems should be based on new wide band, multimode, flexible radio access. This approach will ensure that systems based on 3GPP specifications will be capable of rapid development and deployment of competitive service offerings while still enabling global roaming.

TSG Radio Access Network (TSG RAN) is responsible for the definition of the functions, requirements and interfaces of the UTRA/E-UTRA network in its two modes, FDD & TDD. More precisely: radio performance, physical layer, layer 2 and layer 3 RR specification in UTRAN/E-UTRAN; specification of the access network interfaces (Iu, Iub, Iur, S1 and X2); definition of the O&M requirements in UTRAN/E-UTRAN and conformance testing for User Equipment and Base Stations...more

SA

The TSG Service and System Aspects (TSG-SA) is responsible for the overall architecture and service capabilities of systems based on 3GPP specifications and, as such, has a responsibility for cross TSG co-ordination...more

GERAN

Operators of GSM/GPRS systems need a strategy for future growth and interoperability, the evolution of GSM/EDGE radio access technologies offers such a path. TSG GERAN is responsible for the specification of the Radio Access part of GSM/EDGE...more

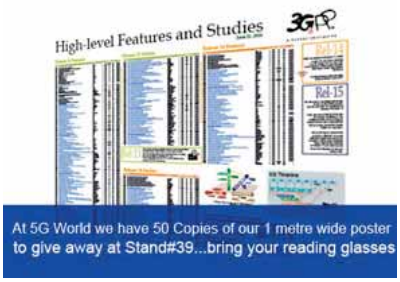
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CT

The TSG Core Network and Terminals (TSG CT) is responsible for specifying terminal interfaces (logical and physical), terminal capabilities (such as execution environments) and the Core network part of 3GPP systems...more

Historical Information (Incl. Closed groups)

The original specification work started in 1987, with the first Phase of GSM specifications. If you have an ETSI On-Line account (ETSI Members), you can access the ETSI Technical Committee SMG documents (including Change Requests) via the On-line archive. For past & present 3GPP group's meeting documents (including Change Requests) choose the appropriate Technical Specification Group's (...)
more »

TSG Working Agreements

"Working Agreements" are tentative decisions reached by 3GPP groups in order to make progress on matters where consensus [1] cannot be reached. See the 3GPP Working Procedures, article 25. See document PCG20_04 (slides 4 & 5) for further background information. To propose additions to this page: 3GPPcontact@3gpp.org. Only working agreements explicitly documented in meeting reports (...)
more »

email lists

3GPP E-mail Exploder Lists

A full list of the 3GPP email exploder lists is available at http://list.3gpp.org/ This also contains all the ETSI exploder lists, however the majority of the 3GPP lists are located right at the top. In order to subscribe to any of these lists please scroll down until you find the list you are interested in, click on the link and follow the simple instructions. Those delegates who already (...)
more »

Uniform Resource Identifier (URI) list

Uniform Resource Name values maintained by 3GPP: The tables below list URIs registered by 3GPP. Applications for new entries must be made via email to the TSG CT WG1 Secretary. Applications must contain: a proposal for the URN value; a brief description of its functionality; a reference to the specification or other publicly available document (if any) containing the definition; the (...)
more »

OMA dependecies and overlaps

The table below shows the 3GPP work items which have some dependency on or overlap with work being carried on within the Open Mobile Alliance. It is intended to help manage the relationship between OMA and 3GPP.

Only areas where 3GPP has agreed to use OMA outputs are included. There may be other areas of dependency and overlap on which 3GPP agreement has not yet been reached.
Only high-level relationships (mainly at the "feature" level) are listed.

more »

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```
 9/26/2012  5:02 PM        <dir> .Trash-root
 5/18/2015  6:18 PM        <dir> aspnet_client
 4/23/2015  1:11 PM        <dir> Inbox
12/9/2014  3:31 PM        <dir> Information
 9/26/2012  5:03 PM        <dir> Invitation
 5/18/2015  2:41 PM        <dir> Joint_Meetings
 8/13/2015  2:00 PM        <dir> Meetings_3GPP_SYNC
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  7/1/2015  8:57 AM        <dir> PCG
  9/8/2015  3:13 PM        <dir> Specs
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2/17/2015 10:49 AM        <dir> tsg_ct
7/27/2015 12:27 PM        <dir> tsg_geran
11/4/2008  9:08 PM        <dir> tsg_ran
9/17/2014 12:00 PM        <dir> tsg_sa
11/4/2008 10:08 PM        <dir> tsg_t
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11/7/2014  5:28 PM        <dir> webExtensions
6/19/2015 10:41 AM        <dir> workshop
```

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www.3gpp.org - /ftp/tsg_ran/

[To Parent Directory]

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 4/21/2015  9:10 AM        <dir> TSG_RAN
 7/21/2015 10:31 AM        <dir> WG1_RL1
 8/11/2015 10:19 AM        <dir> WG2_RL2
 9/22/2015 10:10 PM        <dir> WG3_Iu
 9/14/2015  1:33 PM        <dir> WG4_Radio
 6/26/2015  9:53 AM        <dir> WG5_Test_ex-T1
 11/4/2008  9:08 PM        <dir> WGs_LongTermEvolution
```

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[To Parent Directory]

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The Wayback Machine - https://web.archive.org/web/20161006170918/http://www.3gpp.org:80/ftp/tsg_ra…

www.3gpp.org - /ftp/tsg_ran/WG1_RL1/TSGR1_86b/

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APPENDIX 20



3GPP_TSG_RAN_WG1 Archives

September 2016, Week 2

New in LISTSERV 17.0 ×

3GPP_TSG_RAN_WG1@LIST.ETSI.ORG

Options: Use Monospaced Font
Show Text Part by Default
Show All Mail Headers

Message: [<< First] [< Prev] [Next >] [Last >>]
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Author: [<< First] [< Prev] [Next >] [Last >>]

Subject: Draft agenda for RAN1 #86bis
From: Satoshi Nagata <nagatas@NTTDOCOMO.COM>
Reply To: Satoshi Nagata <nagatas@NTTDOCOMO.COM>
Date: Tue, 13 Sep 2016 23:23:10 +0900
Content-Type: multipart/mixed
Parts/Attachments: text/plain (618 bytes) , text/html (6 kB) , R1-16xxxx Draft Agenda RAN1_86bis_ver0.doc (77 kB)

Dear all,

Considering the limited time between the next plenary and RAN1 #86bis, I would like to send the first version of draft agenda for RAN1 #86bis before the plenary.

Please note followings
(1) I will update this first version after seeing the plenary outcome
(2) Seeing the current rapporteurs' updated SID/WID, I captured some new sub-agendas with brackets for existing SI/WI. After seeing the results of plenary, I will update these bracket parts.
(3) Patrick will not open 3GU Tdoc allocation before Friday of the plenary's week (23rd Sep.)
It means that you can not request Tdoc for RAN1 #86bis now

ATOM RSS1 RSS2

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APPENDIX 21



3GPP_TSG_RAN_WG1 Archives

October 2016, Week 3

New in LISTSERV 17.0 ×

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3GPP_TSG_RAN_WG1@LIST.ETSI.ORG

Options: Use Monospaced Font
Show Text Part by Default
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Subject: [RAN1#86bis]: Preliminary report
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Reply To: Patrick Merias <[log in to unmask]>
Date: Thu, 20 Oct 2016 17:22:58 +0000
Content-Type: multipart/mixed
Parts/Attachments: text/plain (2280 bytes) , text/html (11 kB) ,
Draft_Minutes_report_RAN1#86b_v010.zip (881 kB)

Dear all,

A first version of the report is attached…

- All available docs (2431) are now uploaded to 3GPP server as well as a preliminary Tdoc_list made available to the 3GU portal – Tdocs statuses should be ok for LS and CRs, the others still requesting some later updates
- Please check whether Annex B reflects all agreed CRs (hopefully I haven't forgotten any – 66 CRs agreed according to my record)

FYI following add-on was made due to wrong CR number
R1-1609952 Draft CR for RI transmission on PUSCH for LAA Scells Qualcomm Incorporated
Conclusion:

- The CR in R1-1609952 is endorsed in principle, with the following updates:
  - Add change marks to the two new tables
  - Add references to the two new tables
- Final CR to prepared. Agreed as CR0224 to 36.212 (Rel-14) in R1-1610998

Post meeting: MCC to correct CR number by replacing 0777 to 0224 before submission to plenary.

Also note 377 delegates checked-in using the electronic feature – with such figure reflecting the participation to RAN1#86bis, I believe no complain can be raised regarding the size of the main meeting room!!
Remember that once the meeting has closed and local server switched-off, adding manually missing info to the participants list is not possible.

Will keep on-going checking and entering correct contributions' statuses into 3GU and monitoring the current email discussions…

Relax a bit (if possible) after a very busy week!

ATOM RSS1 RSS2

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APPENDIX 22

3GPP TSG RAN WG1 Meeting #87 R1-1611081
Reno, USA, 14th – 18th November 2016

Source: MCC Support

Title: Final Report of 3GPP TSG RAN WG1 #86bis v1.0.0 (Lisbon, Portugal, 10th – 14th October 2016)

Document for: Approval



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Main facts summary

3GPP TSG WG RAN1 #86bisbis meeting, hosted by the European Friends of 3GPP, was held at the ALTIS GRAND HOTEL, Lisbon, Portugal.
The meeting started at 9:05 on Monday 10th October and finished at 17:07 on Friday 14th October 2016.
The number of attending delegates, having confirmed their participation through the electronic check-in application, was **337.**
Note that the number of registered was 511.

The list of action points that required RAN1 close follow-up is listed in Annex F (end of document).

The number of contributions for this meeting was 2438, and those documents were categorized as followed.

Agenda Item	Input Document	Treated Document
All	2438	906

Note: The amount of documents includes those discussed during the email discussion session post meeting.

Note that the number of agreed CRs was 71.

	Contribution is agreed/approved
	Further discussion is required – come-back needed
	Working assumption
	Specific action needed from MCC
	Contribution is for email discussion/approval

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1 Opening of the meeting

Mr Satoshi Nagata (RAN1 Chairman) welcomed the participants of the RAN WG1 86 meeting and opened the meeting at 09:05. Mr Shin Horng Wong from Sony welcomed the delegates on behalf of the European Friends of 3GPP, Alcatel-Lucent, Apple, BlackBerry, Deutsche Telekom, Ericsson, Huawei, Intel, KPN, Motorola, Nokia, Orange, Qualcomm, SIMAlliance, Sony, TeliaSonera, Telefonica, TIM, Telenor, Vodafone and detailed the domestic arrangements for the full week.

1.1 Call for IPR

The attention of the members of this Technical Specification Group was drawn to the fact ***that 3GPP Individual Members have the obligation*** *under the IPR Policies of their respective Organizational Partners to* ***inform their respective*** *Organizational Partners* ***of Essential IPRs they become aware of****.*
The members take note that they are hereby invited:

- *to investigate whether their organization or any other organization owns IPRs which were, or were likely to become Essential in respect of the work of 3GPP.*
- *to notify their respective Organizational Partners of all potential IPRs, e.g., for ETSI, by means of the IPR Information Statement and the Licensing declaration forms (e.g. see the ETSI IPR forms http://webapp.etsi.org/Ipr/).*

1.2 Competition law statement

The Chairman also drew Member's attention to the fact that 3GPP activities are subject to antitrust and competition laws and that compliance with said laws is therefore required of any participant of this WG meeting including the Chairman and Vice Chairmen. In case of question, please contact your legal counsel.
The present meeting will be conducted with strict impartiality and in the interests of 3GPP.
Furthermore, the Chairman reminded Members that timely submission of work items/contributions in advance of WG meetings is important to allow for full and fair consideration of such matters.

1.3 Network usage conditions

The PCG has laid down the following network usage conditions:

Users shall not use the network to engage in illegal activities. This includes activities such as copyright violation, hacking, espionage or any other activity that may be prohibited by local laws.

Users shall not engage in non-work related activities that consume excessive bandwidth or cause significant degradation of the performance of the network.
Since the **network is a shared resource**, users should exercise some basic etiquette when using the 3GPP network at a meeting. It is understood that high bandwidth applications such as downloading large files or video streaming might be required for business purposes, but delegates should be strongly discouraged in performing these activities for personal use. Downloading a movie or doing something in an interactive environment for personal use essentially wastes bandwidth that others need to make the meeting effective. The meeting chairman should remind end users that the network is a shared resource; the more one user grabs, the less there is for another. Email and its attachments already take up significant bandwidth (certain email programs are not very bandwidth efficient). In case of need the chair can ask the delegates to restrict IT usage to things that are essential for the meeting itself.

1. DON'T place your WiFi device in ad-hoc mode
2. DON'T set up a personal hotspot in the meeting room
3. DO try 802.11a if your WiFi device supports it
4. DON'T manually allocate an IP address
5. DON'T be a bandwidth hog by streaming video, playing online games, or downloading huge files
6. DON'T use packet probing software which clogs the local network (e.g., packet sniffers or port scanners)

2 Approval of Agenda

R1-1610440 Draft Agenda of RAN1#86bis meeting RAN1 Chair (R1-1608561)
Satoshi Nagata (Chairman) proposed the agenda for the meeting, as well the schedule of the week.
Discussion: No comment.
Decision: The agenda is approved.

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3 Approval of Minutes from previous meeting

R1-1608562 Final Report of 3GPP TSG RAN1 #86 v1.0.0 ETSI
The document was presented by Patrick Mérias (ETSI Mobile Competence Center) and provides the outcomes of last meeting in Sweden.
Discussion: MCC→ recalled a rather simple working rule when CR needs to be revised (increment revision each time a formal CR is revised)
Decision: The document is approved.

4 Highlights from RAN Plenary

R1-1608563 Selected highlights from RAN#73 of relevance to RAN1 RAN1 Chair
The document was presented by RAN1 Chair and feedbacks the decisions made by RAN#72, relevant to RAN1.
Discussion: Chair → regarding the additional ad-hoc meetings for NR, current view is as follows:

- January 2017 – 5days meeting – in the US (exact location still to be defined)
- June 2017 – 4days meeting – in China (exact location still to be defined)
- September 2017 - 4days meeting – location TBD, likely in Asia (Japan, India)

Decision: The document is noted.

5 Incoming Liaison Statements

R1-1608565 LS on Support of CAT 9/10 and CAT 13 RAN2, Intel
The document was presented by … from Intel. RAN2 agreed to use existing IEs i.e the UE indicates both ue-Category-v1170 (= Category 9/10) and ue-CategoryDL-r12 (= Category 13) when it supports both Category 9/10 and Category 13. RAN2 confirms that there is no backward compatibility issue when the UE sends both UE category IEs.
Decision: The document is noted.

R1-1608571 LS on introduction of new UL categories in Rel-13 RAN2, Qualcomm
The document was presented by … from Qualcomm. Based on the LS from RAN1 on introduction of new UL categories in Rel-13 (R1-168459)., RAN2 endorsed the attached CRs to TS36.306 and TS36.331 to be sent to RAN for decision.
Discussion: No action to RAN1.
Decision: The document is noted.

LAA related
R1-1608572 LS on CSI measurement ambiguity in LAA RAN4, LGE
The document was already treated in RAN1#86 (R1-167928).
Decision: The document is noted.

R1-1609168 Discussion on RAN4 LS on CSI measurement ambiguity in LAA LG Electronics

- Proposal 1. Agree with the proposed text and introduce a corresponding Rel-13 CR (drafted in [R1-1609170]), where it should be decided first whether the yellow-highlighted text should be introduced as well or not. Then, inform RAN4.
- Proposal 2: Agree on the draft CR for Rel-13 LAA in [R1-1609169] which reflects previous RAN1 agreement on the CSI reference resource definition. Then, answer the issue 2 in RAN4 LS with information on the agreed CR.

Discussion: Intel is also supporting the proposal.
Decision: The document is treated under AI 7.1.3.

R1-1609934 Draft LS response to 802.11 regarding LAA Qualcomm Incorporated
Discussion: Chair → already discussed in last meeting, can we agree it as baseline?
Ericsson/Huawei: ok to take it as a baseline but more discussion required for wording improvement
Decision: The document is noted. Continue offline discussion until Friday – (Qualcomm)
Friday: Response LS has been agreed in the CR maintenance session (see R1-1611031 under 7.1.7) – it covers partially the topics of the original LS from IEEE.

R1-1608567 LS on Timing reference for LAA SCell RAN2, LGE
In order to handle the TA of LAA SCells without RA, as one solution, RAN2 suggests configuring a TAG including only LAA SCells and use N_{TA} for that TAG as zero. Considering that a timing reference cell within an sTAG is an activated SCell in that sTAG, if we allow configuring a TAG including only LAA SCells, an LAA SCell should be used as a timing reference cell for that TAG. Question to RAN4 Under which conditions the UE can consider that the LAA SCell is a reliable timing reference cell for UL transmissions?
Discussion: No action to RAN1.
Decision: The document is noted.

R1-1608570 Reply LS on ECID positioning for TDD RAN2, CATT

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The document was presented by … from CATT and confirms that RAN1 and RAN4 agreements on ECID TDD related measurements have been taken into account, and based on the assumptions that E-SMLCs will be upgraded to new LPP and new UEs will only use behaviour 1, RAN2 approved three CRs: 36.355 CR (R2-165956), 36.331 CR (R2-165954), 36.306 CR (R2-165955)
Decision: The document is noted.

R1-1608579 LS for definition of SSTD measurement RAN4, CATT
The document was presented by … from CATT and asks RAN1 to modify the definition of SFN and subframe timing difference (SSTD) measurement as proposed.
Decision: The document is noted.

R1-1608580 LS on on UCG parameters for eMTC RAN4, Intel
The document was presented by … from Intel. RAN4 has discussed frequency synchronization during continuous transmissions by HD-FDD eMTC UEs and has concluded the following:

1. Frequency error requirement for Cat-M1 UE is relaxed to 0.2 ppm for f<1 GHz
2. For UEs that need uplink compensation gaps (UCG) the gap period (X) is 256 ms and gap length (Y) is 40 ms
3. The UEs that don't need UCG shall be enabled to operate without UCG implementation
4. UCG is not needed for any PRACH configuration

Decision: The document is noted.

R1-1608581 LS on LTE Rel-13 UE feature list RAN4, Qualcomm, Intel
The document was presented by … from Qualcomm and asks RAN2 to develop the capability signalling for Rel-13 UEs taking this UE feature list into account.
Discussion: No action to RAN1.
Decision: The document is noted.

V2X related
R1-1608564 LS Response on QoS requirements for V2X RAN2, Intel
The document was presented by Alexey Khoryaev from Intel and reports following RAN2 agreements and assumptions.

- RAN2 does not expect V2X PC5 resources to be shared with other non-V2X applications.
- For mode 1, RAN2 agrees that PPPP and other QoS parameters provided by higher layers will be used.
- For mode 2, RAN2 assumes that PPPP can be used to ensure QoS for PC5 V2V.
- For proposed QCI characteristics in S2-162662, RAN2 confirms two new QCIs and observation that two QCI values with different PDB can be assigned with the same priority.

Discussion: No action to RAN1.
Decision: The document is noted.

R1-1608566 LS on Exceptional Pool Handling for V2X RAN2, OPPO
The document was presented by … from OPPO. The RRC specification will include the exceptional pool in SIB21 (for the non-handover cases like idle-to-connected, RLF, RRCReconfiguration, etc.), and pre-sensing on the exceptional pool is used for exceptional pool provided by serving cell. For handover case, an "exceptional" pool is provided by the target cell. The UE uses random selection on this pool based on the concern that sensing may cause latency issue in the transition states.
RAN1 is asked to feedback if there is any concern with this solution, in particular with the use of random selection on the exceptional pool for handover case.
Decision: The document is noted.

R1-1608582 Reply LS on QoS requirements for V2X SA2, LGE
The document was presented by … from LGE and provides the following feedback to RAN2:

A1) SA2 confirms that enforcing UE-PC5-AMBR is not necessary for mode 2 operation. This is because the network is not expected to control the amount of resources consumed when the UE operates in mode 2.
A2) SA2 considers the PDB as the latency requirement from the application layer (i.e. 20ms or 100ms as defined in TS 22.185). The latency can be derived from PPPP by the AS layer, which is based on the mapping between the PPPP and latency provided by configuration to be defined in SA2.
A3) SA2 assumes that the V2X UE in limited service state shall follow the similar principles for the ProSe Direct Communication specified for ProSe-enabled Public Safety UEs set forth in clause 4.5.6 of TS 23.303. However, final confirmation needs to be made by SA1 from service perspective.

Discussion: No action to RAN1.
Decision: The document is noted.

R1-1608569 LS on RAN2 agreements on FeMBMS RAN2, Qualcomm
The document was presented by … from Qualcomm and reports RAN2 conclusions:

- Working Assumption: For non-standalone case, Rel-14 FeMBMS carrier broadcasts MIB and all SI needed to receive FeMBMS transmission in Idle mode. Which of the necessary SI and contents are FFS.

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- Agreements:
  - The Rel-14 FeMBMS carrier does not support paging functionality for mobile terminating calls.
  - For non-standalone case, from RAN2 point of view, subframes 0, 4, 5, 9 (FS1) and 0, 1, 5, 6 (FS2) can be used as MBSFN subframes for FS1 (FS2) in an eMBMS carrier. It is understood that 100% MBSFN subframe allocation allows for subframes to be set aside, for example, for cell search and broadcasting of necessary system information.

Decision: The document is noted.

R1-1608575 Reply LS on blind detection evaluations RAN4, MediaTek

The document was presented by … from MediaTek and reports RAN4 conclusions:

- MUST Case 1 and Case 2 : For NOMA near UE
  - Blind detection on interference existence is not feasible
    - The degradation due to existence detection error is significant for either OMA to NOMA or NOMA to OMA
    - Practical blind detection algorithms cannot achieve acceptable detection rate for both 1-layer and 2-layer in CRS-based TMs
  - Blind detection on power ratio is not feasible
- MUST Case 3: Unequal power allocation between spatial layers in CRS-based TMs is not feasible in terms of UE blind detection complexity

Decision: The document is noted.

R1-1608577 Reply LS on SRS carrier switching interruption time RAN4, Huawei

The document was presented by Weimin Xiao from Huawei and states:

Given that the RF switching time may have some dependency on the CA scenarios and UE implementation, RAN4 agrees that the RF switching time can be defined in the following values:

- 0 us / 30 us / 100 us / 200 us / 300 us / 500 us / 900 us
- Any values equal to or larger than 1ms are not considered because it may negate the potential gains of enabling SRS switching in the first place. Note that this RF switching time does not include UL transmit timing difference between two TAGs, which is up to 32.47us, or any channel access delay caused by LBT in the case of LAA operation.

Depending on UE implementation, network configuration, CA scenarios, and RAN1 design, DL reception of PCell or SCells may be impacted due to SRS switching.

Decision: The document is noted.

mobility enhancements

R1-1608568 LS on further mobility enhancements RAN2, ZTE

The document was presented by Zhisong Zuo from ZTE. RAN2 agreements regarding

- the RACH-less solution:
  1) The asynchronous RACH-less solution is excluded.
  2) Only the RACH-less solution that the TA value of the source cell is reused for the targeted cell, or TA=0 will be further considered.
  3) The subframe allocation and uplink grant format can be configured by RRC message. If the subframe allocation and uplink grant format is configured, the starting subframe of the configured uplink grant is provided by the target eNB in RRC message. If UE doesn't receive UL grant in RRC message, it will monitor PDCCH of the target eNB for UL grant. UE doesn't need to know the SFN of the target eNB.
  4) RACH-less solution can be used for SCG change and handover scenarios.
- the make-before-break solution:
  1) The "make before break handover solution" means the UE continues downlink and uplink with the source cell until the UE performs the first transmission through PUSCH or PRACH to the target eNB.
  2) The solution is applicable for intra frequency handover and SCG change. Inter frequency case is FFS.
  3) Consider RACH-less solution and "maintaining a connection to the source eNB" as two independent mechanisms, activation of which is up to the network decision. Two solutions can be activated simultaneously.

Discussion: No action to RAN1.

Decision: The document is noted.

R1-1609936 On RAN2 LS on further mobility enhancements Qualcomm Incorporated

- Observation 1: From the LS description, the timing and the duration of the grant provided via RRC are unclear.
- Observation 2: The benefit of defining a new grant type and transmitting via RRC instead of using legacy PDCCH scheduling is not justified.
- Observation 3: Without a power control mechanism for PUSCH transmission when RACH is skipped, the uplink transmissions will fail and UE power and uplink resources will be wasted.
- Observation 4: Using the existing dynamic grant and TPC mechanism, the eNB can control uplink power. If upper layer grant is used, this is not possible.

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- Proposal: RAN1 to respond to RAN2 LS by recommending not to define a new upper layer grant and instead use the existing PUSCH scheduling procedure when RACH is skipped during E-UTRA handover.

Decision: The document is noted. Continue offline discussion until Friday – Peter (Qualcomm)
Friday: Not much progress achieved. Discussion posponed to next meeting.

R1-1608576 Reply LS on the feasibility of mobility enhancement solutions RAN4, Ericsson, ZTE
The document was presented by … from Ericsson and provides the following clarifications:

- The legacy accuracy requirements for uplink timing alignment, i.e. the accuracy of TA for initial uplink transmission, cannot be met by UE calculated TA scheme in either synchronous or asynchronous network. The TA calculation error comes from TA error of source cell, UE reception time difference, BS transmission time alignment error, and uplink/downlink imbalance.
- If it is feasible to start PUCCH/PUSCH/SRS transmission directly is up to RAN1. RAN4 would like to point out that without PRACH power ramping step the transmission power accuracy could be impacted.
- The feasibility and accuracy of network based timing offset estimation in asynchronous case is within the domain of RAN3 to evaluate. From a RAN4 perspective, any error in the estimated timing offset between source and target eNBs will cause doubled error in the calculated TA value.

Discussion: No action to RAN1.
Decision: The document is noted.

R1-1608578 LS on Measurement gap enhancement RAN4, Ericsson, Intel
The document was presented by … from Ericsson and asks RAN WG2 to start to consider the signalling necessary to introduce the gap enhancements described in the liaison statement.
Discussion: No action to RAN1.
Decision: The document is noted.

NR related
R1-1608573 Response LS on Modelling and simulation of IMT networks for use in sharing and compatibility studies RAN4, Ericsson
The document was presented by … from Ericsson and asks RAN to approve and forward the LS to ITU-R WP5D.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-1608574 LS on Characteristics of terrestrial IMT systems for frequency sharing/interference analysis in the frequency range between 24.25 GHz and 86 GHz RAN4, Nokia
The document was presented by … from Nokia and asks RAN to approve and forward the LS to ITU-R WP5D in advance of the ITU-R WP5D meeting in October 2016.
Decision: The document is noted.

R1-1608583 Reply LS on NR requirements RAN, ZTE
The document was presented by … from ZTE and provides the following guidance:

- There are two types of latency requirements in TR38.913: latency-only (sec. 7.5, where no value for eV2X is defined) and latency + reliability (sec. 7.9, applicable to URLLC and eV2X). Both are to be considered best case targets.
  - There are no exact latency requirements for URLLC and eV2X during successful mobility events, but it can be assumed that in the ideal scenario they are close to the corresponding latency + reliability requirements.
  - For failure cases, RAN2 should aim at minimizing interruption times.
- For the latency-only target (not defined for eV2X), some radio error rate may be considered (e.g. HARQ Retransmission), but likely no UE speed assumption. For the latency + reliability requirement, RAN1 will define separate UE speed and error rate assumptions for URLLC and eV2X as part of their work on the evaluation environments and methodology for URLLC and eV2X services. For eV2X, the maximum UE speed is currently set to 250 km/h but could be further modified after further SA1 input.
- The latency requirements in TR 38.913 apply to the 5G radio network, and there needs to be a way for the 5G radio network to meet the requirements. Not all possible configurations and options need to meet all the requirements. In the context of the NR Study Item, the control plane latency requirement applies for the case when NR is the anchor.
- The latency requirements in TR 38.913 apply to the 5G radio network, and there needs to be a way for the 5G radio network to meet the requirements. Not all possible configurations and options need to meet all the requirements. In the context of the NR Study Item, the user plane latency requirement applies for the cases when NR or LTE is the anchor and user plane data transmission only happens through the NR node.

Discussion: No action to RAN1.
Decision: The document is noted.

The following set of LS was received in the course of the meeting week:
R1-1610565 LS on Multi-carrier enhancements for UMTS RAN2, Ericsson
R1-1610680 LS on TTI switching for MC enhancements RAN2, Huawei

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R1-1610765 LS on RAN2 agreements on FeMBMS RAN2, Ericsson
Decision: The document is noted. The LS was treated under AI 7.2.4.
R1-1610766 LS to RAN1 on V2V agreements RAN2, LGE

6 UTRA

R1-1610573 Report of the UMTS sessions UMTS Session Chairman's Notes (Carmela Cozzo, Huawei)
The document was presented by Gerardo Medina from Ericsson on behalf of Carmela Cozzo.
Decision: The document is endorsed and content incorporated below.

6.1 Maintenance of UTRA Releases 4 – 13

None.

6.2 Multi-Carrier enhancements for UMTS - WID in RP-161259.

6.2.1 TTI switching

R1-1610194 HS-SCCH order design for TTI switching Huawei, HiSilicon
R1-1610233 On introducing the HS-SCCH orders for enabling TTI Switching in Multicarrier Enhancements in UMTS Ericsson

Agreement on HS-SCCH orders for TTI switching:

Table 14B.3A: Orders for switching the E-DCH TTI for single cell E-DCH

Extended Order Type	Order Type	Order Mapping			Interpretation
$X_{eodt,1}$, $X_{eodt,2}$	$X_{odt,1}$, $X_{odt,2}$, $X_{odt,3}$	$X_{ord,1}$	$X_{ord,2}$	$X_{ord,3}$	
11	011	0	0	0	TTI switch order from 2ms to 10ms
		0	0	1	TTI switch order from 10ms to 2ms
		0	1	0	Unused (Reserved single cell E-DCH)
		0	1	1	Unused (Reserved single cell E-DCH)
		1	0	0	Unused (Reserved single cell E-DCH)
		1	0	1	Unused (Reserved single cell E-DCH)
		1	1	0	Unused (Reserved single cell E-DCH)
		1	1	1	Unused (Reserved single cell E-DCH)

Table 14B.3B: Orders for switching the E-DCH TTI for dual cell E-DCH

Extended Order Type	Order Type	Order Mapping			Interpretation
$X_{eodt,1}$, $X_{eodt,2}$	$X_{odt,1}$, $X_{odt,2}$, $X_{odt,3}$	$X_{ord,1}$	$X_{ord,2}$	$X_{ord,3}$	
11	011	0	0	0	Unused (Reserved dual cell E-DCH)
		0	0	1	Unused (Reserved dual cell E-DCH)
		0	1	0	TTI switch order to 2ms+2ms
		0	1	1	TTI switch order to 2ms+10ms
		1	0	0	TTI switch order to 10ms+2ms
		1	0	1	TTI switch order to 10ms+10ms
		1	1	0	Unused (Reserved dual cell E-DCH)
		1	1	1	Unused (Reserved dual cell E-DCH)

Note 1 (Table 14B.3B): For the TTI switch orders the TTI length displayed on the left hand side applies to the primary uplink frequency, while the TTI length displayed on the right hand side applies to the secondary uplink frequency.

Note 2 (Table 14B.3B): The TTI switch orders also apply if the secondary uplink frequency is deactivated, but it becomes effective on the secondary uplink frequency upon its re-activation.

R1-1610572 LS to RAN2/3 on the agreements on TTI switching RAN1

6.2.2 Power scaling

R1-1610193 Considerations on power scaling rules for 2ms+10ms configurations Huawei, HiSilicon

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R1-1610234 On Power Scaling and Multicarrier Enhancements for UMTS Ericsson

Conclusion: For proposal in R1-1610193, it is encouraged to show use cases (throughput) for next meeting.

6.2.3 Other

R1-1610195 Response to RAN2 LS on MC enhancements Huawei, HiSilicon
R1-1610196 Configuration of physical layer parameters for MC enhancements Huawei, HiSilicon
R1-1610235 On the "Response LS" related to the configuration of DTX along with the Rel-14 Multicarrier Enhancements for UMTS Ericsson

R1-1610571 LS to RAN2/3 Response LS RAN1

R1-1610236 Primary Carrier Switching for Multicarrier Enhancements in UMTS Ericsson

Conclusion: continue discussing the proposal in R1-1610236

6.3 DTX/DRX enhancements in CELL_FACH - WID in RP-160185.

6.3.1 DRX improvements

R1-1609782 Introduction of HS-SCCH Order for HS-SCCH DRx feature in enhanced Cell Fach Qualcomm Europe Inc.(France)
Decision: CR0344 to 25.2.12 (Rel-14) is agreed.
R1-1609784 UE Procedures for HS-SCCH DRx feature in enhanced Cell Fach Qualcomm Europe Inc.(France)
Decision: CR0758 to 25.2.14 (Rel-14) is agreed.

6.3.2 DTX improvements

R1-1610237 An assessment on the potential gains in cell throughput derived from fully applying DTX on the stand alone UL DPCCH transmissions in CELL_FACH Ericsson

7 E-UTRA

7.1 Maintenance of E-UTRA Releases 8 – 14

Only essential corrections.
Note that individual companies can submit draft CRs to this agenda item for Rel-13 items.

R1-1610882 Chairman's notes of AI 7.1 on CRs Ad-Hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm.
Discussion: Ad-hoc chair →Typo needs to be fixed (R1-1609173 should be read as R1-1610773)
Decision: The document is endorsed and content incorporated below.

7.1.1 Maintenance of E-UTRA Release 8 – 12

Friday: Following contribution deals with the benefits of introducing new TBS values for DL 256QAM, and is a follow-up of RAN's decision requesting to discuss further this issue in the Working Groups.
R1-1610413 Introduction of new Transport Block Size for DL 256QAM Qualcomm
Decision: The document is noted for email approval until Oct.27th – (Qualcomm)

7.1.2 Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers

R1-1610094 Clarification on a few PUCCH format 4 and 5 related issues in eCA Qualcomm Incorporated
Conclusion:

- For the 3 issues discussed in R1-1610094,
  - The 1st and 3rd issues are for email discuss till 10/21 (Peter, Qualcomm)
  - The proposals for the 2nd issue is aligned with RAN1 understanding (i.e., $N_{\mathrm{ID}}^{\mathrm{csh\_DMRS}}$, if configured by higher layers for PUSCH, is also applicable to PUCCH format 4 and 5). CR to be prepared for the next RAN1 meeting.

R1-1610852 Correction on PDCCH candidate configuration LG Electronics
Decision: Email approval of R1-1610852 till 10/21 – Seonwook (LG Electronics)

7.1.3 Maintenance of Release 13 licensed-assisted access to unlicensed spectrum

R1-1609168 Discussion on RAN4 LS on CSI measurement ambiguity in LAA LG Electronics
R1-1609169 Correction on CSI reference resource definition in LAA LG Electronics

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Decision: Draft CR in R1-1609169 is endorsed. Final CRs to be prepared.
Friday: CR0780 to 36.213 (Rel-13) is agreed in R1-1611027 and shadow CR0781 to 36.213 (Rel-14) is agreed in R1-1611028.
Post-meeting: MCC to change category F to A in R1-1611028.

R1-1610773 Correction on CSI measurement in LAA LG Electronics (R1-1609170)
Decision: Draft CR in R1-1610773~~09173~~ is endorsed. Final CRs to be prepared.
Friday: CR0782 to 36.213 (Rel-13) is agreed in R1-1611029 and shadow CR0783 to 36.213 (Rel-14) is agreed in R1-1611030.
Post-meeting: MCC to change category F to A in R1-1611030.

R1-1610841 [Draft] Reply LS on CSI measurement ambiguity in LAA LGE
Decision: The document is noted and final LS is approved in R1-1611026.

R1-1609937 Discussion on periodic and aperiodic CSI reporting in LAA Qualcomm Incorporated
R1-1609938 Draft CR on aperiodic CSI reporting in LAAQualcomm Incorporated

R1-1609368 Draft CR on energy detection threshold for DL multi-carrier operation for LAA in 36.213 Huawei, HiSilicon
R1-1610462 Draft CR on energy detection threshold for DL multi-carrier operation for LAA in 36.213 Huawei, HiSilicon

R1-1610197 Correction on CWp adjustment on Type B1 multi-carrier access procedure for Rel-13 LAA WILUS Inc.
Decision: CR0754 to 36.213 (Rel-13) is agreed in R1-1610450 .

7.1.4 Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE

R1-1609171 Correction on NZP CSI-RS aggregation for Class A LG Electronics
Decision: CR0296 to 36.211 (Rel-13) is agreed in R1-1610451.

R1-1609449 Correction on periodic CSI reporting mode 2-1 for Class B FD-MIMO Intel Corporation, ZTE, ZTE Microelectronics
R1-1610428 Correction on periodic CSI reporting mode 2-1 for Class B FD-MIMO Intel Corporation, ZTE Corporation, ZTE Microelectronics
Decision: CR0755 to 36.213 (Rel-13) is agreed in R1-1610452 **Correction to PUCCH reporting mode 2-1**
Prepare Rel-14 CR within Monday – Alexei (Intel)
Decision: CR0757 to 36.213 (Rel-14) is agreed in R1-1610454

R1-1609450 Correction on periodic CSI reporting mode 1-1 for Class B FD-MIMO Intel Corporation, ZTE, ZTE Microelectronics
Decision: CR0756 to 36.213 (Rel-13) is agreed in R1-1610453 **Correction to PUCCH reporting mode 1-1**
Prepare Rel-14 CR within Monday – Alexei (Intel)
Decision: CR0758 to 36.213 (Rel-14) is agreed in R1-1610455

7.1.5 Maintenance of Release 13 further LTE physical layer enhancements for MTC

R1-1610439 Correction of typos due to wrong implementation of CR0283 "Clarification of valid subframe in eMTC" MCC
Decision: CR0295 to 36.211 (Rel-13) is agreed.
R1-1611020 Correction of typos due to wrong implementation of CR0283 "Clarification of valid subframe in eMTC" MCC
Decision: CR0308 to 36.211 (Rel-14) is agreed.

PRACH
R1-1610447 Correction of PRACH starting subframes for eMTC Intel Corporation (Revision of R1-1609451)
Decision: The CR is endorsed. Final CRs to be prepared.
CR0303 to 36.211 (Rel-13) is agreed in R1-1610914 and shadow CR0304 to 36.211 (Rel-14) is agreed in R1-1610915.

MPDCCH
R1-1609605 Correction to DMRS for MPDCCH associated with P-RNTI Virtuosys Limited, Qualcomm Incorporated, Intel Corporation
Decision: CR0289 to 36.211 (Rel-13) is agreed. Also to prepare a shadow CR for Rel-14 (Mark, Virtuosys).
R1-1610504 Correction to DMRS for MPDCCH associated with P-RNTI Virtuosys Limited, Qualcomm Incorporated, Intel Corporation
Decision: CR0298 to 36.211 (Rel-14) is agreed.

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R1-1609941 CR for clarification on i_0 value Qualcomm Incorporated
R1-1610208 Draft CR for correction on MPDCCH hopping Qualcomm Incorporated
R1-1610742 CR for clarification on i_0 value Qualcomm Incorporated
Decision: The CR is endorsed. Final CRs to be prepared.
CR0301 to 36.211 (Rel-13) is agreed in R1-1610911 and shadow CR0302 to 36.211 (Rel-14) is agreed in R1-1610912.

R1-1610474 Correction on equation for MPDCCH search space and starting subframe position NTT DOCOMO, INC., Panasonic (Revision of R1-1610028)
Decision: The draft CR in R1-160474 is endorsed. Prepare final CR, including Rel-14 shadow CR (Naoto, DCM).
CRs are provided in R1-1610497 **and R1-1610501**. Prepare updated CRs with 'ME' box checked (Naoto, DCM).
R1-1610796 Correction on equation for MPDCCH search space and starting subframe position NTT DOCOMO, Panasonic
Decision: CR0767r1 to 36.213 (Rel-13) is agreed.
R1-1610797 Correction on equation for MPDCCH search space and starting subframe position NTT DOCOMO, Panasonic
Decision: CR0768r1 to 36.213 (Rel-14) is agreed.

R1-1610308 DraftCR: 36.213 Clarification on the reference subframe k in ECCE determination in a MPDCCH search space Sony
R1-1610408 DraftCR: 36.213 Clarification on the reference subframe k in ECCE determination in a MPDCCH search space Sony Europe Limited
Decision: The CRs in R1-1610308 and R1-1610408 are not necessary.

R1-1610369 Correction on MPDCCH monitoring in special subframes Huawei, HiSilicon
Decision: The CR in R1-1610369 is not necessary

R1-1610370 Correction on MPDCCH transmission without repetition Huawei, HiSilicon
Decision: Continue discussion offline (Huawei)
R1-1610778 Correction on MPDCCH transmission without repetition Huawei, HiSilicon
Decision: CR0291 to 36.211 (Rel-13) is agreed. Prepare Rel-14 shadow CR (Zheng, Huawei)
R1-1610926 Correction on MPDCCH transmission without repetition Huawei, HiSilicon
Decision: CR0307 to 36.211 (Rel-14) is agreed.

CSI
R1-1609939 Draft CR clarification on spectral efficiency Qualcomm Incorporated
Decision: The draft CR in R1-1609939 is endorsed. Prepare final CR, including Rel-14 shadow CR (Alberto, Qualcomm)
Final decision: CR0763 to 36.213 (Rel-13) is agreed in R1-1610493 and CR0765 to 36.213 (Rel-14) is agreed in R1-1610495

R1-1609942 CR for clarification on A-CSI without hopping Qualcomm Incorporated, Samsung
Decision: The draft CR in R1-1609942 is endorsed (to fix the indentation). Prepare final CR, including Rel-14 shadow CR (Alberto, Qualcomm)
CRs are provided in R1-1610494 **and R1-1610496**. Prepare updated CRs to fix the spacing and the date (Alberto, Qualcomm)
CRs are provided in R1-1610837 **and R1-1610838**. Prepare updated CRs to fix the indentation (Alberto, Qualcomm)
Final decision: CR0764r2 to 36.213 (Rel-13) is agreed in R1-1610944 and CR0766r2 to 36.213 (Rel-14) is agreed in R1-1610945

PUSCH
R1-1609940 Draft CR clarification on PUSCH repetition levels Qualcomm Incorporated
Decision: The CR in R1-1609940 is not necessary

PUCCH/SRS
R1-1609826 Clarification of number of repetitions of PUCCH ZTE
Continue discussion offline (Huiying, ZTE)
Decision: CR0769 to 36.213 (Rel-13) is agreed in R1-1610648 and CR0771 to 36.213 (Rel-14) is agreed in R1-1610656

R1-1610382 Clarification of PUCCH and SRS not belonging to any narrowband for BL/CE UE Ericsson
R1-1610749 WF on PUCCH and SRS not belonging to any narrowband for BL-CE UE Ericsson, Intel, Qualcomm, Sequans, Sony, ZTE

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R1-1610919 WF on PUCCH and SRS not belonging to any narrowband for BL-CE UE Ericsson, Alcatel-Lucent Shanghai Bell, AT&T, Intel, Nokia, NTT DoCoMo, Orange, Qualcomm, Sequans, Sony, Sierra Wireless, Virtuosys, ZTE, ZTE Microelectronics

- BL/CE UE can transmit PUCCH in any PRB.
- BL/CE UE drops SRS transmission in subframe *n* when PUCCH transmission occurs in subframe *n* or *n+1* in a PRB not belonging to a narrowband.

Note: No specification change is required from the above proposals.

Decision: The document is noted. Also supported by Verizon

Conclusion:

- It is RAN1 understanding that BL/CE UE can transmit PUCCH in any PRB.
- It is RAN1 understanding that BL/CE UE drops SRS transmission in subframe *n* when PUCCH transmission occurs in subframe *n* or *n+1* in a PRB not belonging to a narrowband.
- It is RAN1 understanding that BL/CE UE may need retune to/from transmitting PUCCH in a PRB not belonging to a narrowband when necessary
- Note: No specification change is required from the above proposals.

7.1.6 Maintenance of Release 13 NB-IoT

PDSCH

R1-1608706 CR on 36.211 NB-IoT PDSCH symbol mapping Ericsson
R1-1610409 CR on 36.211 NB-IoT PDSCH symbol mapping Ericsson
Both CRs are not pursued.

NPDCCH

R1-1608707 CR on 36.213 NB-IoT Type1 and Type 2 search space definition Ericsson
Decision: The CR is endorsed in principle.
R1-1610733 CR on 36.213 NB-IoT Type1 and Type 2 search space definition Ericsson
R1-1610734 CR on 36.213 NB-IoT Type1 and Type 2 search space definition Ericsson
Decision: CR0751r1 to 36.213 (Rel-13) is agreed in R1-1610733 and CR0752r1 to 36.213 (Rel-14) is agreed in R1-1610734

R1-1609403 Correction on the determination of NPDCCH candidates ITRI
R1-1609404 Correction on the determination of NPDCCH candidates ITRI
Decision: CR0746 to 36.213 (Rel-13) is agreed in R1-1609403 and CR0747 to 36.213 (Rel-14) is agreed in R1-1609404

NPRACH

R1-1609452 Correction of NPRACH frequency hopping Intel Corporation
Decision: The CR in R1-1609452 is endorsed in principle.
R1-1610756 Correction of NPRACH frequency hopping Intel Corporation
Decision: CR0305 to 36.211 (Rel-13) is agreed in R1-1610916 and CR0306 to 36.211 (Rel-14) is agreed in R1-1610917

R1-1609680 Clarifications about NPRACH configuration parameters Nokia, Alcatel-Lucent Shanghai Bell
R1-1609679 Clarifications about NPRACH configuration parameters Nokia, Alcatel-Lucent Shanghai Bell
R1-1610412 Clarifications about NPRACH configuration parameters Nokia, Alcatel-Lucent Shanghai BellNote: For 240 msec period values, an overlap with the next HSFN occurs for 32 repetitions

R1-1610018 Clarification on power ramping for NPRACH MediaTek Inc.
R1-1610770 WF on Clarification of NPRACH for single/multi-tone MSG 3 Mediatek

- If there is no resource reserved for multi-tone MSG 3 in a coverage level, UE supports multi-tone MSG 3 can use the NPRACH resources for single-tone MSG 3 in the coverage level.
- If there is no resource for single-tone MSG 3 in a coverage level,
  - For Rel-13, no additional CR for current specs. This means,
    - If all the PRACH resources are for multi-tone MSG 3 in a coverage level, multi-tone MSG 3 incapable UE cannot transmit NPRACH if the UE belongs to that coverage level.
    - If there is no NPRACH resources for single-tone MSG 3 in the next coverage level, multi-tone MSG 3 incapable UE stays in current level.
  - Further study for Rel-14 if UE support single tone MSG 3 transmission can use other coverage level and the need of additional power ramping.

Decision: The document is noted

Conclusion:

- RAN1 concludes that random access resource selection procedure in MAC specification may need some clarification at least for multi-tone-message-3 capable UEs. Companies may bring CRs to RAN2

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NRS
R1-1609827 Clarification on nrs-Power related description ZTE
Decision: The CR in R1-1609827 is endorsed in principle.
R1-1610649 Clarification on nrs-Power related description ZTE
R1-1610657 Clarification on nrs-Power related description ZTE
Decision: CR0770 to 36.213 (Rel-13) is agreed in R1-1610649 and CR0772 to 36.213 (Rel-14) is agreed in R1-1610657

Collision Handling
R1-1610471 CR for clarification on NPRACH and NPUSCH collision Qualcomm Incorporated (Revision of R1-1609943)
Decision: The CR in R1-1610471 is endorsed. Final CRs to be prepared (including Rel-14 shadow CR)
Decision: CR0299 to 36.211 (Rel-13) is agreed in R1-1610505 and CR0300 to 36.211 (Rel-14) is agreed in R1-1610506.

7.1.7 Maintenance of Release 14 Enhanced Licensed-Assisted Access to Unlicensed Spectrum

R1-1608980 Draft CR on start timing of PUSCH Samsung
Decision: The CR0297 to 36.211 (Rel-14) is agreed in R1-1610475.

R1-1609174 Correction on UL grant reception in ending partial subframe LG Electronics
Decision: The CR0759 to 36.213 (Rel-14) is agreed in R1-1610456.

R1-1609175 Correction on UL burst scheduling LG Electronics
R1-1610775 Correction on UL burst scheduling LG Electronics
Decision: The CR is endorsed. Final CR to be prepared.
Final decision: The CR0760 to 36.213 (Rel-14) is agreed in R1-1610457

R1-1609367 Draft CR on PHICH operation for eLAA in 36.213 Huawei, HiSilicon
Decision: The CR0761 to 36.213 (Rel-14) is agreed in R1-1610458.

R1-1609569 [Draft 36.212 CR] Corrections to RV in eLAA DCI definitions Nokia, Alcatel-Lucent Shanghai Bell
Decision: The CR0221 to 36.212 (Rel-14) is agreed in R1-1610459.

R1-1609576 Draft CR on DCI formats related with LAA in TS 36.212 ETRI
R1-1610463 Draft CR on DCI formats related with LAA in TS 36.212 ETRI
Decision: The CR0222 to 36.212 (Rel-14) is agreed in R1-1610476 with following update (deletion of text):
Else~~10463(212), 10464(213)~~,

R1-1610464 Draft CR on UL duration and offset field in TS 36.213 ETRI
Decision: The CR is endorsed. Final CR to be prepared.
Final decision: The CR0774 to 36.213 (Rel-14) is agreed in R1-1610896

R1-1609577 Draft CR on timing offset field in TS 36.213 ETRI

R1-1610198 Correction on PUSCH RE mapping in case of multiple subframe scheduling WILUS Inc.
R1-1610199 Correction on handling UL LBT procedure under UE power limited case WILUS Inc.
Final decision: The draft is agreed as CR0762 to 36.213 (Rel-14) in R1-1610460 with following update
If the beginning of UE transmission in subframe $n+1$ immediately follows the end of UE transmission in subframe n, the UE is not expected to be indicated with different channel access types for the transmissions in those subframes .
If the UE is scheduled to transmit in subframes $n_0, n_1, \cdots, n_{w-1}$ ~~using Type 1 or Type 2 channel access procedure~~ using a PDCCH DCI Format 0B/4B, and if the UE has stopped transmitting during or before subframe

R1-1610200 Clarification on channel access priority class according to UL LBT type indication in eLLA DCI WILUS Inc.
R1-1610653 Correction on channel access priority class according to UL LBT type indication in eLAA WILUS Inc.
Decision: The CR is endorsed with the following update: moving the change right after the paragraph starting with "The eNB shall schedule UL transmissions…". Final CR to be prepared.
Final decision: The CR0775 to 36.213 (Rel-14) is agreed in R1-1610900.

PUSCH design
R1-1608981 PHR reporting for two-step scheduling Samsung
R1-1608982 CCA slot and tx-rx/rx-tx switching time Samsung
R1-1609172 Discussion on (E)PDCCH candidate configuration LG Electronics
R1-1610853 Correction on PDCCH candidate configuration LG Electronics

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Decision: Email approval of R1-1610853 till 10/21 – Seonwook (LG Electronics)

R1-1609944 **Discussion on UL resource allocation for 10MHz eLAA** **Qualcomm Incorporated**
R1-1609945 Draft 212 CR on UL resource allocation for 10MHz eLAA Qualcomm Incorporated
R1-1609946 Draft 213 CR on UL resource allocation for 10MHz eLAA Qualcomm Incorporated
Decision: Discuss the second and third bullets in R1-1609944 till next meeting

R1-1609953 **Frame structure and maximum timing advance for eLAA** **Qualcomm Incorporated**
Continue discussion next meeting

R1-1609947 **Discussion on trigger monitoring timeline for two stage triggered grants in eLAA** **Qualcomm Incorporated**
R1-1609948 **Draft CR on trigger monitoring timeline for triggered grants in eLAA** **Qualcomm Incorporated**
R1-1611021 **Draft CR on trigger monitoring timeline for triggered grants in eLAA** **Qualcomm**
R1-1611025 **CR on trigger monitoring timeline for triggered grants in eLAA** **Qualcomm**
Final decision: The CR0779 to 36.213 (Rel-14) is agreed.

SRS design
R1-1609950 **Draft CR on SRS dropping rules for eLAA** **Qualcomm Incorporated**
Continue discussion next meeting

UCI
R1-1608978 **Periodic CSI reporting for eLAA Samsung**
R1-1608979 Draft CR on Periodic CSI report Samsung
R1-1609173 **Discussion on periodic CSI transmission LG Electronics**
R1-1610774 **Correction on periodic CSI transmission LG Electronics**
Decision: The CR is agreed in principle, further discussion offline to refine wording. Final CR to be prepared.
R1-1610908 **Correction on periodic CSI transmission LG Electronics**
Decision: The wording to be further refine. Finally agreed as CR0776r1 to 36.213 (Rel-14) in R1-1611007

R1-1609949 **Dicussion on simultanoeus transmission on the non-LAA and LAA Scells** **Qualcomm Incorporated**
Continue discussion next meeting

R1-1609951 **Discussion on RI transmission on PUSCH for LAA Scells** **Qualcomm Incorporated**
R1-1609952 **Draft CR for RI transmission on PUSCH for LAA Scells** **Qualcomm Incorporated**
Conclusion:
- The CR in R1-1609952 is endorsed in principle, with the following updates:
  - Add change marks to the two new tables
  - Add references to the two new tables
- Final CR to prepared. Agreed as CR0224 to 36.212 (Rel-14) in R1-1610998

Post meeting: MCC to correct CR number by replacing 0777 to 0224 before submission to plenary.

R1-1610209 **On simultaneous transmission of periodic and aperiodic CSI in eLAA** **Qualcomm Incorporated**
R1-1610210 Draft CR on simultaneous transmission of periodic and aperiodic CSI in eLAA Qualcomm Incorporated

R1-1610858 **Draft CR on using 25us LBT for UEs on carriers without eNB Cat 4 LBT Qualcomm Incorporated**
Continue discussion next meeting

Channel access
R1-1608659 **Discussion on UL CWS adjustment for eLAA** **Huawei, HiSilicon**
R1-1610996 **Draft CR on UL CWS adjustment for eLAA in 36.213** **Huawei, HiSilicon, Qualcomm, Broadcom, LGE, Ericsson, Intel** (Revision of R1-1609366)
Decision: The CR is endorsed (also check ME in the cover page). Final CR to be prepared.
Decision: Agreed as CR0778 to 36.213 (Rel-14) in R1-1611022

R1-1609777 **Draft CR on eLAA UL Multicarrier channel access** **BROADCOM LIMITED**
Continue discussion next meeting

R1-1609954 **On UE assumptions for UL LBT and start of UL transmission** **Qualcomm Incorporated**
Continue discussion next meeting

R1-1610201 **Discussion on UL Multi-carrier Transmission for eLAA** **WILUS Inc.**
Continue discussion next meeting

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R1-1610202 **Discussion on Handling UL Multicarrier Transmission under UE power limited case** **WILUS Inc.**
R1-1610421 **Removal of LAA DRS channel access from UL Type 2 Channel Access description** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The CR is endorsed. Final CR to be prepared.
Decision: Agreed as CR0773 to 36.213 (Rel-14) in R1-1610884

R1-1610859 **Draft CR on clarification of PUSCH start position for eLAA Panasonic, Qualcomm Incorporated**
Decision: The CR is endorsed. Final CR to be prepared.
Decision: Agreed as CR0223 to 36.212 (Rel-14) in R1-1610886

Friday
R1-1609934 **Response LS to IEEE 802.11 regarding LAA** **Qualcomm**
R1-1611031 **Response LS to IEEE 802.11 regarding LAA** **Qualcomm**

7.1.8 Maintenance of Release 14 V2V services based on LTE sidelink

CR submission is only allowed by specification editors.
Note that proponent can submit discussion contribution to this A.I. which contains a possible TP.

DMRS randomization
R1-1609453 **Proposal to align DMRS cyclic shift for PSCCH and PSSCH (Correction to V2V CR - 36.211)** **Intel Corporation**
Decision: Agreed proposal 1

- Editors to check whether clarification is needed for MSB and LSB of CRC field in SCI format 1.

R1-1610465 **WF on DMRS randomization** **Samsung**
R1-1608715 **Discussion on randomization on DMRS** **CATT**
Decision:
Agreements:

- DMRS randomization of a PSSCH follows the CRC of the SA in the same subframe as the PSSCH
- Discuss in RAN1#87 whether additional mechanism is needed for PSSCH DM RS randomization focusing on the single-subframe transmission case.

R1-1609455 Clarification on V2V Resource Selection Procedure (Correction to V2V CR - 36.213) Intel Corporation
R1-1608983 Further randomization on DMRS and scrambling code Samsung
R1-1609179 Corrections on randomizing PSSCH DM-RSLG Electronics
R1-1609817 TP on random selection of PSCCH cyclic shift ZTE

Resource size for PSCCH and PSSCH
R1-1609955 **Remaining issues for V2V** **Qualcomm Incorporated**
Proposals 3 and 9 only
Decision: Agreed proposals 3 and 9

R1-1609363 **Discussion on resource pool for PC5 based V2V** **Huawei, HiSilicon**
Proposal 1 only

PSCCH and PSSCH transmission in the same subframe
R1-1609373 **Discussion on the remaining issues for sidelink power control** **Huawei, HiSilicon**
Conclusion:

- P_0 can be preconfigured for out-coverage V2V UEs as in Rel-12 D2D
  - This will not have specification impact

R1-1609812 **Discussion on PSD offset with PSCCH and PSSCH** **ZTE**
R1-1609955 **Remaining issues for V2V** **Qualcomm Incorporated**
Proposals 1, 2, and 4 only
Decision: Agreed proposals 1 and 4

- Proposal 2 in R1-1609955 is agreed in principle.

R1-1609177 Discussion on power offset for PSCCH LG Electronics

Background sensing
R1-1610039 **Discussion on background sensing** **NTT DOCOMO, INC.**
R1-1610302 **Discussion on the issue of transmission during the sensing window** **Panasonic**
R1-1609360 Discussion on sensing procedure for PC5 based V2V Huawei, HiSilicon

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R1-1609178 Corrections on excluding resources within selection window LG Electronics
R1-1608984 On resource (re)selection in 36.213 Samsung

Agreements:

- In order to handle the skipped subframe#k in the resource exclusion procedure, the UE shall exclude the subframe#y within its own selection window if the subframe#(y+P*j) can be overlapped with subframe#(k+100*i), where P is the resource reservation interval of the UE, j is 0, 1, …, C_resel-1, i are any (available) elements in the set restricted by carrier-specific network (pre)configuration.
- Continue discussion on the proposal "For a received SA, if initial transmission is before subframe n while retransmission is after subframe n, UE can measure PSSCH-RSRP on initial transmission resource and do resource exclusion by the retransmission resource."

20% rule in resource selection
R1-1609955 Remaining issues for V2V Qualcomm Incorporated
Proposal 5 only
Conclusion:

- Continue discussion on proposal 5 in R1-1609955 till next meeting, especially more evaluation results

Reserved subframes
R1-1609955 Remaining issues for V2V Qualcomm Incorporated
Proposal 6 only
R1-1609729 Outstanding issues for mode-4 resource allocation Ericsson
R1-1608716 Discussion on details of resource reselection CATT
Decision: Continue discussion of proposal 2 next meeting

R1-1609180 Corrections on the set of reserved subframes in SL TM 4 LG Electronics
R1-1608986 Remaining issues on resource reservation Samsung
Conclusion:

- For clarification of C_resel, FFS till next meeting

UE decoding capability
R1-1609751 Discussion on UE decoding capabilities Ericsson
R1-1609361 Discussion on UE capability in decoding PSSCH and PSCCH Huawei, HiSilicon
Conclusion:

- A UE is not expected to try to decode more than N1 RBs in a subframe
  - Further discussion the value of N1 (e.g., 100, 138 or 150)
- A UE is not expected to try to decode more than N2 PSCCHs in a subframe
  - Further discussion the value of N2 (e.g., 10 or 20)
- Further discussion this week whether or not to introduce the specific rule(s) to ensure that transmissions from a given UE are not systematically dropped, and if so, the rule(s)

For the further discussion parts above, continue discussion next meeting

Others
R1-1610461 PSSCH/PSBCH decoding issue CATT (Revision of R1-1608714)
Continue discussion of proposals 2 and 3 till next meeting

R1-1608985 Remaining issues on resource exclusion in Step 2 Samsung
R1-1609176 Discussion on minimum portion of remaining resources for PSSCH LG Electronics
R1-1609362 Discussion on sensing window range for PC5 based V2V Huawei, HiSilicon
Agreements:

- Change the sensing window range to subframes n-1000, n-999, n-998 …, n-1

R1-1609363 Discussion on resource pool for PC5 based V2V Huawei, HiSilicon
Proposal 2 only
Conclusion:

- No change is needed regarding proposal 2 in R1-1609363

R1-1609454 Clarification on Resource Selection Procedure (Correction to V2V CR - 36.213) Intel Corporation
Conclusion:

- Align the name of the field "Frequency resource location" and "Frequency resource location of the initial transmission and retransmission" across technical specification TS 36.212 and TS 36.213 respectively.

R1-1609811 TP on PSBCH ZTE

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R1-1609955 Remaining issues for V2V Qualcomm Incorporated
Proposal 10 only
Agreements:
- Send LS response to R2-165962 with the following contents:
  - RAN1 has not introduced random resource selection for V-UEs and RAN1 has concerns on increased resource collision probability caused by random resource selection. RAN1 notes that random selection for V-UE is not among the list of the objectives transferred from V2V WI.
- LS draft by Ricardo – Ericsson.

R1-1610920 [Draft] LS response on Exceptional Pool Handling for V2X Ericsson
Decision: Final LS is agreed in R1-1610930

R1-1610935 Outcome offline discussion on V2V maintenance LGE

R1-1610977 WF on V2V support for TDD Intel, CATT
Decision: Further discussion next meeting

Not treated.

R1-1610477	Way Forward on UE background sensing	NTT DOCOMO, Panasonic
R1-1610507	Way Forward on Resource Reservation	Samsung
R1-1610769	Way Forward on resource reselection	Samsung, CATT, Huawei, HiSilicon, ZTE

7.1.9 Other

R1-1609552 Introduction of RACHless handover for Further mobility enhancement in LTE ZTE Corporation
Decision: CR0748 to 36.213 (Rel-14) is for email approval until October 20th – (ZTE)

R1-1608717 Correction on SSTD definition CATT
Decision: CR0039 to 36.214 (Rel-13) is agreed.
R1-1609824 Correction on SSTD definition CATT
Decision: Shadow CR0040 to 36.214 (Rel-14) is agreed.

R1-1610106 Discussion on power allocation for SC-PTM TD Tech, Huawei
R1-1610901 Correction on downlink power allocation for SC-PTM TD Tech, Huawei (R1-1610110)
Further revised in R1-1611045.
R1-1611045 Correction on downlink power allocation for SC-PTM TD Tech, Huawei
Decision: CR0749r2 to 36.213 (Rel-13) is agreed.

Agreement:
- SC-MCCH uses a fixed modulation of QPSK.
  - No signaling of PA and PB for SC-MCCH.
- RAN1 recommends that for each SC-MTCH, there is a higher layer parameter "PA" for configuring ρ_A for the PDSCH carrying the SC-MTCH.
  - If "PA" is not signaled by high layer, the UE may assume that "PA" is equal to 0 dB.
- RAN1 recommends that for each cell supporting SC-PTM, there is a higher layer parameter "PB" for configuring ρ_B/ρ_A for any SC-MTCH in the cell.
  - If "PB" is not signaled by high layer, the UE may assume that $\rho_B/\rho_A = 1$.

R1-1610748 [DRAFT] LS on power allocation for SC-PTM Huawei
Agreed in R1-1610780

7.2 LTE Release 14

Friday
For MUST, Further indoor positioning enh., SRS carrier based switching, Performance enhancements for high speed:
- Rapporteurs will provide list of agreements, including WA until Oct. 17th.
- Spec editors (36.201, 36.211, 36.212, 36.213, 36.214) shall provide draft CRs based on above lists until Nov. 10th
- All proponents are invited checking the draft CRs until next meeting

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7.2.1 LTE-based V2X Services - *WID in RP-161894*

R1-1610864 Chairman's notes of AI 7.2.1 on LTE-based V2X Services Ad-Hoc chair (LGE)
The document was presented by Hanbyul Seo from LGE.
Decision: The document is endorsed and content incorporated below.

Friday
R1-1611061 [Draft] LS on RAN1 agreements potentially related to RAN2/4 in LTE-based V2X LG Electronics
Decision: The document is noted and final LS is agreed in R1-1611066.

R1-1610936 Outcome offline discussion on V2X LG Electronics

R1-1609932 SC-PTM Enhancements for V2X MediaTek Inc.
R1-1609933 On suitability of Uu transport and PC5 transport for V2X Solutions MediaTek Inc.

Agreements:
- From RAN1 viewpoint, the following three cases can be supported regarding the capability of LTE V2X devices on the simultaneous transmission of UL and SL.
  - Case 1: UL TX and SL TX use separate TX chains and separate power budget
  - Case 2: UL TX and SL TX use separate TX chains but sharing power budget
  - Case 3: UL TX and SL TX share TX chains and power budget
  - It is noted that the most suitable case may be dependent of the V2X use case.
- RAN WGs to identify solution(s) that takes into account the minimum performance of SL TX at least for some important SL TX. RAN WGs needs to reduce possible degradation of Uu operation performance in identifying such solution(s).
  - For case 1, RAN1 assumes no physical layer solution is needed.
- Send LS to RAN2/4 to inform this understanding and to ask them to reflect this in the UE capability discussion.
  - LS drafted by Yi – Huawei

R1-1610966 [Draft] LS on V2X UE transmission chain Huawei, [RAN1]
Decision: The document is noted and final LS is agreed in R1-1611000.

7.2.1.1 *Enhancement to UL and SL SPS*

7.2.1.1.1 DCI design to support multiple SPS configurations

Including details of SPS RNTI for V2X, indicator(s) in DCI to differentiate SPS configurations

DCI contents
R1-1610556 DCI design to support multiple SPS configurations CATT (R1-1608718)
R1-1610037 Multiple SPS support for sidelink and uplink V2X NTT DOCOMO, INC.

R1-1610776 WF on reliable sidelink SPS NTT DOCOMO, CMCC, LG Electronics
Proposed agreements:
- At least one of the following mechanism is supported for sidelink SPS controlled by eNB
  - A/N feedback mechanism on the reception of DCI indicating SL SPS activation/release
    - FFS on details.
  - Automatic release after a counter is expired
    - Further detail is up to RAN2
  - When a SPS configuration is activated for an SPS process, previously configured SPS process is released
    - UE identifies a SPS process associated to a DCI based on the contents of the DCI, for example,
      - Option 1: One-to-one mapping between SPS configuration index and SPS process
      - Option 2: Semi-static (higher layer configured) association between SPS configuration index and SPS process. Multiple SPS configurations can be associated to a SPS process.
      - Option 3: Dynamic indication (explicitly or implicitly) of SPS process associated to a SPS DCI
    - Further detail is FFS

Agreement: Activation of one SPS configuration releases the previous allocation for the same SPS configuration.

R1-1610813 WF on DCI design for SL SPS LG Electronics, ZTE, Samsung, CATT, Huawei, HiSilicon

Agreements:
- An SL SPS RNTI different from SL dynamic scheduling RNTI is defined.
- The following two fields are additionally included in the existing dynamic scheduling DCI (i.e., DCI 5A).

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- Working assumption:
  - SL SPS configuration index : 3 bits
  - Activation/release indication : 1 bit
- Each SL SPS DCI contains a single SPS configuration index.
- If the number of information bits in SL SPS DCI format mapped onto a given search space is less than the payload size of DCI format 0 mapped onto the same search space, zeros shall be appended to SL SPS DCI format until the payload size equals that of DCI format 0 including any padding bits appended to DCI format 0.
  - FFS whether the size of SL SPS DCI format can be larger than the size of DCI format 0 on the same search space.

R1-1610812 WF on DCI design for V2X UL SPS LG Electronics, Samsung, ZTE, NTT DOCOMO, Huawei, HiSilicon

Agreements:
- Working assumption: A V2X UL SPS RNTI different from the legacy SPS C-RNTI is defined.
- The following existing field in DCI 0 (for the legacy UL SPS activation/release) is reused to indicate V2X UL SPS configuration index.
  - Working assumption: Cyclic shift DM RS (3bits)
    - TPC command (2 bits) can be considered as an alternative if this working assumption is not confirmed.
- Each UL SPS DCI contains a single SPS configuration index.

Not treated.

R1-1608595	SPS enhancement for V2V mode 1	Huawei, HiSilicon
R1-1608596	SPS enhancement for V2X on Uu interface	Huawei, HiSilicon
R1-1608650	DCI design for sidelink SPS scheduling	Huawei, HiSilicon
R1-1608987	Support of multiple UL SPS configurations	Samsung
R1-1608988	Remaining details on DCI design for Mode 3	Samsung
R1-1609181	Remaining details of UE procedure for sidelink and uplink SPS	LG Electronics
R1-1609290	Discussion on SL-SPS DCI and cross carrier scheduling	CMCC
R1-1609401	Discussion on DCI design to support multiple SPS configurations	Lenovo
R1-1609570	Signalling design on supporting SPS for slidelink transmission mode 3	Panasonic
R1-1609732	SL-SPS and DCI design for V2X	Ericsson
R1-1609752	UL-SPS and DCI design for V2X	Ericsson
R1-1609804	Scheduling of V2X SPS resources	ZTE
R1-1609888	Details of multiple SPS configurations for V2X over Uu	Potevio
R1-1609956	Uplink SPS enhancements for V2X	Qualcomm Incorporated

7.2.1.1.2 Other

Including explicit release and implicit release mechanism for SPS

R1-1609182	Remaining details of (E)PDCCH design of sidelink and uplink SPS	LG Electronics
R1-1609719	Mechanisms for releasing V2X SPS	Ericsson

7.2.1.2 Resource selection for pedestrian UEs

R1-1609727	Pools for V2X	Ericsson LM

7.2.1.2.1 Details of random selection by pedestrian UEs

Resource pool

R1-1609805	Details of random selection by pedestrian UEs	ZTE
R1-1609865	Random Resource Selection for Pedestrian UEs	Sharp
R1-1609786	Comments on Pool Configuration with Random Resource Selection	Nokia, Alcatel-Lucent Shanghai Bell

Issues related to TX/RX capability

R1-1609787	On resource selection for V2P communication	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609456	Random resource selection by pedestrian UEs for V2V communication	Intel Corporation
R1-1609183	Details of random resource selection for P-UE	LG Electronics
R1-1610212	On random resource selection for V2P	Ericsson
R1-1609402	Discussion on random selection by pedestrian UEs	Lenovo

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7.2.1.2.2 Details of resource selection using partial sensing by pedestrian Ues

R1-1610739 WF on P-UE sensing timeline in partial sensing Huawei, HiSilicon, NTT Docomo
R1-1611016 WF on P-UE sensing timeline in partial sensing Huawei, HiSilicon, Sequans, ZTE, Sony

Agreement:

- The following aspects needs to be addressed to define resource selection based on partial sensing
  - How to determine the subset of subframes in which UE performs sensing
  - How to determine the subset of subframes for the candidates of resource selection
  - How to relate these two subsets
- Study the above aspects in terms of PRR and energy consumption:

Not treated.

R1-1608649 Discussion on the P-UE resource selection Huawei, HiSilicon
R1-1608719 Discussion on P-UE resource selection CATT
R1-1608899 Details of partial sensing by pedestrian UEs Sequans Communications
R1-1608911 Discussion on resource sensing and selection for pedestrian UEs Spreadtrum Communications
R1-1608947 Discussion on details of partial sensing for pedestrian UEs Sony
R1-1608989 Partial sensing for pedestrian UE Samsung
R1-1609184 Discussion on partial sensing for P-UEs LG Electronics
R1-1609457 Partial sensing for P2V communication Intel Corporation
R1-1609681 Discussion on partial sensing of pedestrian UEs Beijing Xinwei Telecom Techn.
R1-1609724 Partial sensing for V2P Ericsson
R1-1609806 Details of resource selection using partial sensing by P-UEs ZTE
R1-1609866 Further Discussions on Power Efficient Sensing for P-UEs Sharp
R1-1609957 Sensing based resource selection for V2P Qualcomm Incorporated
R1-1610035 Discussion on details of pedestrian UE partial sensingNTT DOCOMO, INC.

7.2.1.2.3 Other

R1-1608658 Discussion on the necessity of differentiating P-UE and V-UE Huawei, HiSilicon

7.2.1.3 Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels

Target is to complete this by RAN#74. Solution(s) to be specified should avoid negative impact on the performance of LTE PC5. Possible solutions identified during the study item are "Geo-location and database," "Time sharing between systems based on GNSS timing," and "Sensing-based vacate/switching approaches with or without transmission of a predetermined signal(s)."

R1-1608594 Coexistence of 802.11p and V2V services Huawei, HiSilicon
R1-1609185 Considerations on the co-channel coexistence of multiple RATs for V2X LG Electronics
R1-1610418 Co-channel coexistence for DSRC and LTE-V2V Qualcomm Incorporated (R1-1609958)

R1-1610728 WF on ITS Coexistence Mechanisms Ericsson, Huawei, HiSilicon

Agreements:

- The following two aspects need to be discussed with regard to the usefulness of an detection option
  - Usefulness when IEEE802.11p detects LTE
  - Usefulness when LTE detects IEEE802.11p
- Study until the next meeting on the usefulness of the following options
  - Option 1: Detecting the pattern of LTE CP
  - Option 2: Detecting a sequence of LTE transmitted within the last symbol of a subframe
  - Option 3: Detecting periodically transmitted LTE signal (e.g., SLSS)
  - Option 4: Measuring energy

Not treated.

R1-1609458 Design considerations on LTE-V2V coexistence with DSRC technology Intel Corporation
R1-1609710 Discussion on Coexistence Between Different Technologies for ITS Services Ericsson
R1-1609711 Detection Sequence in LTE-ITS Sidelink for Coexistence with Other Access Technologies Ericsson
R1-1609807 Co-channel coexistence between DSRC and LTE V2V on same channel ZTE

7.2.1.4 Support of inter-PLMN for Uu and PC5

R1-1609186 Discussion on support of inter-PLMN for Uu and PC5 LG Electronics

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R1-1609346 Inter-PLMN operation on PC5 Huawei, HiSilicon
R1-1609409 Coordinated and uncoordinated operation in inter-PLMN for V2X scenario ITRI
R1-1609959 Inter-PLMN support for PC5 and Uu Qualcomm Incorporated
R1-1610301 Discussion on inter-PLMN V2X over Uu and PC5 Ericsson

7.2.1.5 Aspects transferred from WI LTE SL_V2V-Core

7.2.1.5.1 Congestion control for PC5-based V2X

Including load balancing across multiple carriers

Congestion level measurement metric definition
R1-1609709 Radio measurements for congestion control for V2X Ericsson
R1-1608990 Discussion on congestion control Samsung
Section 3

Congestion control mechanism
R1-1609960 Congestion control for V2V Qualcomm Incorporated
R1-1609459 Sidelink congestion control for V2X services Intel Corporation
Sections 3, 5, 6
R1-1609187 Discussion on congestion control for PC5-based V2X LG Electronics
Section 2.2, 2.3

R1-1610753 WF on congestion control Huawei, HiSilicon, Ericsson, OPPO, Nokia
Also supported by NEC

Agreements:
- Channel busy ratio (CBR) is defined for the congestion measurement over PC5 in V-UEs
  - CBR is the portion of sub-channels whose S-RSSI exceed a (pre-)configured threshold observed during (working assumption: 100 ms).
    - Only the sub-channels included in the resource pool are used for the measurement.
    - FFS whether additional separated measurement is needed for SA pool.
  - For a UE in Mode 3, the eNB indicates a set of resources on which the UE perform this measurement
  - For a UE in Mode 4, the measurement is pool-specific.
    - A UE measures at least on its current TX pool(s).
      - FFS whether a UE measures on a pool which is not its current transmission pool.
    - RAN1 will not optimize this measurement to address the case of multiple TX pools
- UE Reporting of CBR to eNB is supported
  - Details up to RAN2 including any possible additional averaging at higher layer
- Send LS to RAN2/4 to inform this agreement.

Not treated.
R1-1608592 Congestion control for V2V Huawei, HiSilicon
R1-1608720 Measurement metric for the congestion level in V2X CATT
R1-1608909 UE measurement based congestion control Guangdong OPPO Mobile Telecom.
R1-1608948 Discussion on details of congestion control Sony
R1-1609141 Discussion on congestion control in distributed scheduling mode NEC
R1-1609142 Discussion on congestion control in eNB scheduling mode NEC
R1-1609571 Discussion on channel busy ratio measurement in V2X Panasonic
R1-1609699 Outstanding Physical Layer Structure Details and Receiver Behavior for Sidelink V2V Ericsson
R1-1609707 Autonomous Resource allocation for multiple retransmissions Ericsson
R1-1609712 Congestion Control Framework for V2V Ericsson
R1-1609788 On congestion control for PC5-based V2X Nokia, Alcatel-Lucent Shanghai Bell
R1-1609808 Discussion on congestion control of PC5 carrier ZTE

7.2.1.5.2 Simultaneous Uu and PC5 operations in different carriers

R1-1609188 Discussion on power cotrol for simultaneous SL TX and WAN TX in different carriers LG Electronics
R1-1609347 Timing alignment for cross-carrier operation Huawei, HiSilicon

7.2.1.5.3 Remaining enhancement to sidelink synchronization

Including SLSS-based synchronization and offset to shift the DFN #0 w.r.t the reference timing derived from GNSS.

LS received during the week:

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R1-1610798 LS on DFN offset RAN2, Huawei

Agreement: Send an LS response to R1-1610798 with the following starting point:

- RAN1 has no concern because the network configuration for this offset can be aligned with the offset in the pre-configuration.

R1-1610847 [Draft] LS response on DFN offset [RAN WG1], Ericsson
Decision: The document is noted and final LS is agreed in R1-1610929 with correcting the WI code to "LTE_V2X-Core."

R1-1609720 Receiver Timing Assumptions for V2V SL Operation Ericsson

Agreements:

- Reuse Rel-12 D2D mechanism of indicating synchronization of each RX pool with the following change:
  - GNSS can be added or can replace the cell ID.
- It is RAN1's understanding that a single FFT per carrier can be used to receive these Sidelink processes (note that this does not imply anything about whether the UE is expected to receive on more than one carrier simultaneously).
- RAN1 understanding is an IE similar to the current SL-SyncConfig can be reused for the case where GNSS is among the synchronization reference of a pool. Details are up to RAN2.
- UE selects only one transmission synchronization reference at a time based on the synchronization reference selection procedure.
- The TX pool (pre-)configuration includes the type(s) of sync reference that is allowed in using each pool.
  - For a pool, specification supports any combination of the following:
    - SyncRef directly or indirectly derived from eNB
      - This includes UE's own timing and SLSS originated from a stand-alone UE
    - SyncRef directly or indirectly derived from GNSS

R1-1610672 Way Forward on the SLSS Transmission Huawei, HiSilicon, Qualcomm , LG Electronics, Ericsson, Samsung, CATT, ITRI, NTT DOCOMO, OPPO, Nokia, ASB

Agreements:

- If the vehicle UE has selected the GNSS as syncRef,
  - For the OOC case:
    - The UE transmits SLSS and PSBCH every synchronization period when the SLSS resource is pre-configured and the UE is capable of SLSS/PSBCH transmission;
      - FFS whether any SLSS/PSBCH dropping behaviour is specified, e.g., for congestion control.
  - For the InC case:
    - Rel-12 D2D mechanism is reused, i.e.:
      - RSRP threshold or dedicated signaling to determine the SLSS transmission
  - When GNSS is the highest priority, the UE is not expected to read SLSS from other UEs.
- UE capability of SLSS transmission/reception will be discussed later.

Friday:
Ericsson→ comment to the following WA adding the statement "UE indirectly synchronized to GNSS"
LGE (rapporteur)→ suggested to add it as FFS note
Agreement is modified as shown below and RAN1 chair tasked rapporteur to prepare an LS to RAN2/RAN4 (see R1-1611061)

Agreements:

- Rel-12 mechanism is re-used to determine the subframe used for transmissions of SLSS/PSBCH from out-coverage UEs synchronized to SLSS, i.e., two SLSS resources are pre-configured for an out-coverage UE, one is used for SLSS of UE's syncRef and the other is used for SLSS transmission of the UE.
- Working assumption: An out-coverage UE directly synchronized to GNSS transmits SLSS/PSBCH on the pre-configured sync resource which is one of the two preconfigured sync resources.
  - FFS: Out-coverage UE indirectly synchronized to GNSS
  - In the other resource, the UE receives PSBCH potentially transmitted from an in-coverage UE.
- FFS whether a UE that selected SLSS ID = 0 as its sync reference transmits SLSS = X (FFS 0 or 168) and PSBCH in a different resource.
  - FFS PSBCH content if transmits

R1-1610673 Way Forward on Sync Priority for OOC Huawei, HiSilicon, LG Electronics, Qualcomm, ZTE, ITRI, DCM, Xinwei, Samsung, NEC, CATT, Ericsson, Nokia, ASB

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Agreements:

- If the UE detects no eNB in a carrier which is (pre-)configured as the carrier which potentially includes eNBs used as sync reference, the following priority rules should be applied:
  - P1: GNSS
  - P2: the following UE has the same priority:
    - UE directly synchronized to GNSS
    - UE directly synchronized to eNB
  - P3: the following UE has the same priority:
    - UE indirectly synchronized to GNSS (if RAN1 decides to differentiate between direct and indirect synchronization to GNSS)
    - UE indirectly synchronized to eNB
  - P4: the remaining UEs have the lowest priority.
- The priority order between P1 and P2 can be (pre-)configured.
  - Note: It is RAN1 understanding that P1 will be prioritized over P2 if the eNB prioritizes GNSS over eNB timing.

Agreement: If the UE detects an eNB in a carrier which is (pre-)configured as the carrier which potentially includes eNBs used as sync reference,

- If GNSS is prioritized over eNB by eNB configuration, UE directly or indirectly synchronized to GNSS has a higher priority than eNB.

R1-1610711 Way Forward on the pre-defined SLSS IDs for the GNSS timing Huawei, HiSilicon, ZTE, Samsung, ITRI, CATT, LG Electronics, NTT DOCOMO, Qualcomm, Nokia, ASB

Agreement: For the V2V PC5 SLSS

- If the vehicle UE has selected the GNSS as syncRef and acts as a synchronization source, SLSS ID is set to 0 for SLSS transmissions.

R1-1610740 Way Forward on V2V PC5 SLSS transmission Huawei, HiSilicon, OPPO, ITRI

Proposed agreements:

- When a UE loses GNSS, the UE still transmits the synchronization signal based on its previous GNSS timing for a certain time duration (timer definition and duration up to RAN2/RAN4)
- Send LS to RAN2 and RAN4

Agreement:

- PSBCH contains 48 bits
- DM RS OCC of PSBCH

Orthogonal sequence	$\left[w^{\lambda}(\cdot)\right]$	$[+1 \quad +1]$ if $N_{\mathrm{ID}}^{\mathrm{SL}} \bmod 2 = 0$ $[+1 \quad -1]$ if $N_{\mathrm{ID}}^{\mathrm{SL}} \bmod 2 = 1$	$[+1,+1,+1]$ if $N_{\mathrm{ID}}^{\mathrm{SL}} \bmod 2 = 0$ $[+1,-1,+1]$ if $N_{\mathrm{ID}}^{\mathrm{SL}} \bmod 2 = 1$

Not treated.

R1-1608651 Discussion on sync priority and SLSS ID set definition Huawei, HiSilicon
R1-1608652 Discussion on PSBCH contents and SLSS transmission procedure Huawei, HiSilicon
R1-1608657 Sidelink synchronization enhancement for V2X communication Huawei, HiSilicon
R1-1608721 Synchronization enhancements in PC5-based V2V CATT
R1-1608910 Discussion on the GNSS based synchronization Guangdong OPPO Mobile Telecom.
R1-1608991 Discussion on SLSS based Sidelink synchronization Samsung
R1-1609143 Discussion on determining timing of sidelink synchronization signals for V2X NEC
R1-1609189 Remaining issues on synchronization enhancements for V2X LG Electronics
R1-1609410 Discussion prioritization of multiple synchronization sources on sidelink synchronization protocol for V2V communication ITRI
R1-1609411 Enhancement to sidelink synchronization among multiple synchronization sources for V2X communications ITRI
R1-1609460 Discussion on V2V synchronization procedure Intel Corporation
R1-1609461 On PSBCH physical layer design for V2V communication Intel Corporation

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R1-1609717 Distributed Synchronization Procedure for V2X over PC5 Ericsson
R1-1609721 Outstanding details of PSBCH for V2V over PC5 Ericsson
R1-1609731 V2V Signals Transmission Dropping for SLSS Reception Ericsson
R1-1609733 SLSS/PSBCH and Transmitter Behavior under Congestion Control Restrictions Ericsson
R1-1609789 Enhancements to sidelink synchronization Nokia, Alcatel-Lucent Shanghai Bell
R1-1609809 Remaining enhancement to sidelink synchronization ZTE
R1-1609961 Synchronization Procedure for V2V Qualcomm Incorporated
R1-1610038 SLSS Enhancements for GNSS based Synchronization NTT DOCOMO, INC.

7.2.1.5.4 Handle multiplexing V2V with other signals/channels

E.g., handling the case where the bitmap for V2V subframes does not repeat an integer number of times within the DFN period

R1-1608722 Multiplexing V2V with other signals/channels CATT
R1-1608992 Remaining details on resource pool configuration Samsung
R1-1609190 Time domain multiplexing of V2V subframes and other signals/channels LG Electronics
R1-1609726 Pool design for V2V Ericsson
R1-1610220 Considerations on handling wrap-around issue in subframe pool configuration for V2V Innovative Technology Lab Co.
R1-1610363 Discussion on subframe bitmap for V2V communication Intel Corporation

R1-1610708 WF on handling multiplexing V2V with other signals/channels LG Electronics, Samsung, Intel

Agreements:

- A pool is configured with a number of reserved subframes such that the bitmap is repeated in an integer number within the DFN range.
  - V2V logical subframe index is not allocated to a reserved subframe.
  - The location of the reserved subframes is indicated by an implicit way (details FFS until next meeting).

7.2.1.5.5 Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period

R1-1609191 Discussion on support of small periodicity resource reservation LG Electronics
R1-1609365 Details for supporting traffic with smaller periodicity on PC5 based V2V Huawei, HiSilicon
R1-1609462 Sidelink enhancements to support V2V traffic with smaller periodicity Intel Corporation
R1-1609734 Support for smaller resource reservation periods in V2X Ericsson
R1-1609810 Discussion on smaller periodicity ZTE
R1-1609962 Low latency support for V2V Qualcomm Incorporated

R1-1610713 WF on supporting traffic with small periodicity for LTE-V2X Huawei, HiSilicon, LG Electronics, Qualcomm, Ericsson

Agreements:

- Support i as 1/5, 1/2 (Pstep fixed at 100) with resource-pool specific configuration of the set of allowed i
  - No change to sensing window and selection window
- Use undefined states of the 4-bit resource reservation field in SCI format 1 to indicate shorter periodicity.
- FFS the following aspects till the next meeting
  - Scale the SL_RESOURCE_RESELECTION_COUNTER to 2(for 50ms period) or 5 (for 20 ms period)
  - S-RSSI measurement interval is (select one of the options at the next meeting)
    - 100 ms interval is kept
    - set to the minimum allowed i
    - set to the resource reservation interval used for transmission of the UE
    - Combination of allowed intervals {20, 50, 100} with shortened averaging duration
  - In step2, reselection UE scales the number of reservations of other UE within selection window by 1/i when 0<i<1.

R1-1610913 WF on enhancement in step 2 for supporting shorter periodicity LG Electronics, CATT

R1-1610932 WF on supporting 50ms periodicity CATT

7.2.1.5.6 Prioritization of SL TX for V2X over WAN TX under eNB management

E.g., SL gap

R1-1608591 Resource allocation in partial coverage Huawei, HiSilicon
R1-1608593 Coexistence of cellular and V2V services Huawei, HiSilicon

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R1-1608723 On Prioritization of SL TX for V2X under eNB management CATT
R1-1608993 Coexistence of PC5-based V2V operation and legacy Uu operation Samsung
R1-1609192 Discussion on prioritizing SL TX over WAN TX LG Electronics
R1-1609364 Coexistence of cellular and V2V services in partial network coverage Huawei, HiSilicon
R1-1609718 On the Need for V2V Gaps Ericsson
R1-1609790 On Prioritization of V2V Sidelink TX over WAN UL TX Nokia, Alcatel-Lucent Shanghai Bell
R1-1609963 Sidelink gap for V2V transmission Qualcomm Incorporated
R1-1610036 Discussion on eNB management of prioritizing V2x SL Tx over WAN Tx NTT DOCOMO, INC.

R1-1610709 WF on prioritization of SL TX over UL TX LG Electronics, NTT DOCOMO, ZTE, NOKIA, Alcatel-Lucent Shanghai Bell, CATT, Samsung
Also supported by Qualcomm

Proposed agreements:
- From RAN1 viewpoint, the following three cases can be supported regarding simultaneous operation of UL TX and SL TX.
  - Case 1: UL TX and SL TX use separate TX chains and separate power budget
  - Case 2: UL TX and SL TX use separate TX chains but sharing power budget
  - Case 3: UL TX and SL TX share TX chains and power budget
- Send LS to RAN2/4 to inform this understanding and to ask it to be reflected in the UE capability discussion.
- When UL TX overlaps in time domain with SL TX then SL TX is prioritized over UL TX if the PPPP of SL packet is above a (pre)configured PPPP threshold.
  - In case of overlapping in the same carrier frequency, the UE shall drop the UL TX.
  - In case of overlapping in different carrier frequency, the UE shall allocate power to the SL TX first.
    - UL TX power is up to UE implementation (including dropping UL TX).
- Send LS to RAN2/4.

R1-1610973 Way forward on prioritizing V2x SL Tx over WAN Tx NTT DOCOMO, LGE, ZTE, NOKIA, Alcatel-Lucent Shanghai Bell, CATT, Samsung, Qualcomm

Agreement: When UL TX overlaps in time domain with SL TX in the shared (or same) carrier frequency,
- the UE shall drop the UL TX if the PPPP of SL packet is above a (pre)configured PPPP threshold, otherwise SL TX is dropped

7.2.1.5.7 Other

R1-1609412 Discussion measurement metric and report for zone based resource management in V2V service ITRI
R1-1609730 Resource allocation for exceptional pools Ericsson

Agreement: Include the following previous RAN1 agreement in the LS which will be sent to RAN WGs to inform all the agreements made in RAN1#86bis
- QPSK and 16QAM are supported in SL-based V2X

7.2.2 Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623

R1-1610610 Chairman's Notes of Agenda Item 7.2.2 Enhancements on Full-Dimension (FD) MIMO for LTE Session Chairmen (Samsung, Nokia)
The document was presented by Matthew Baker from Nokia.
Decision: The document is endorsed and content incorporated below.

R1-1610425 Updated work plan Rapporteurs (Samsung, Nokia, CATT)

Friday
R1-1610938 Outcome of Friday Offline Session on eFD-MIMO Samsung

7.2.2.1 CSI enhancements

7.2.2.1.1 Advanced CSI

Including reduced space representation, enhancements of Rel-8-13 dual-stage codebook and high resolution codebooks

R1-1608597 Overview of advanced CSI feedback for LTE Huawei, HiSilicon
R1-1609921 Design and performance evaluation for advanced CSI feedback Huawei, HiSilicon
R1-1609854 Orthogonal vs. non-orthogonal basis for advanced CSI reporting Ericsson
R1-1609012 Linear combination W1 codebook Samsung

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R1-1609964 Discussion on advanced CSI reporting for eFD-MIMO Qualcomm Incorporated

R1-1610761 WF on Number of Ports Supported in Advanced CSI Huawei, HiSilicon, MediaTek, ZTE, ZTE Microelectronics, Nokia, ASB, Deutsche Telekom, Samsung, Intel, CATT, Xinwei, InterDigital, Oppo, AT&T, China Unicom, ITRI

Working Assumption:

- {4,8,12,16,20,24,28,32} CSI-RS ports are supported in advanced CSI
- Aim for a unified structure, with a single common CSI reporting mechanism which is dimensioned or scalable to support all the numbers of ports
- If it turns out that a particular number of ports is not smoothly supportable, then it can be removed from the list

R1-1610636 WF on Advanced CSI Codebook for eFD-MIMO Samsung, NTT DOCOMO, KT Corporation, AT&T, Mitsubishi Electric, Straight Path, NEC

Proposal:
Rank-1

- $\mathbf{W}_1$: Rel. 13 Class A rank 1 $\mathbf{W}_1$ codebook for Codebook-Config = 2, 3, and 4.
- $\mathbf{W}_2$:
  - Beam selection: L out of 4 beam selection, where L = 2,4
  - Co-phasing per beam: from QPSK {1,j,-1,-j} for l =0,1,…,L-1
  - Coefficient: from QPSK {1,j,-1,-j} for l =1,..,L-1
  - Overhead:
  - i1 or ($i_{1,1}$,$i_{1,2}$): Same as Rel. 13 Class A rank 1 codebook
  - FFS: overhead for i2

Rank-2

- $\mathbf{W}_1$: Rel. 13 Class A $\mathbf{W}_1$ codebook for Codebook-Config = 2, 3, and 4.
  - Alt 0: Class A rank 1 $\mathbf{W}_1$ based
  - Alt 1: Class A rank > 2 $\mathbf{W}_1$ based
  - FFS: down selection between Alt 0 and Alt 1 (and which rank(s) are used)
- $\mathbf{W}_2$:
  - Beam selection: L out of 4 beam selection, where L = 2, 4
  - Co-phase: from QPSK {1,j,-1,-j} for l = 0,1,…,L-1 and for layer r = 0,1
  - Coefficient: from QPSK {1,j,-1,-j} for l = 1,..,L-1 and for layer r = 0,1
  - Design goal: i_2 reporting overhead should be at most equal to that for rank 1

R1-1610772 Way Forward for Quantized Advanced CSI Feedback Structure Ericsson, Huawei, HiSilicon, ZTE, ZTE Microelectronics
Also supported by CATT

Proposal:

- Reduced space basis (eigenvectors)/W1 is constructed based on selecting orthogonal 2D DFT beams
  - TBD: if polarization cophasing is in W1
  - Basis has rotation with oversampling corresponding to at least O1=O2=4
  - Downselect from:
    - Unconstrained selection of N beams
    - Constrained selection using a beam group / beam groups
- Phase and amplitude weighting is applied to combine selected beams from W1
  - Phase weighting is subband, downselect from:
    - Separate weighting for each layer, with [2 or 3] bits quantization per beam per layer
    - Joint encoding of weighting across layers, with [3] bits quantization per beam
  - Downselect amplitude quantization from:
    - Frequency granularity:
      - Wideband using [1 - 3] bits
      - Differential using [1] bits / subband
      - Absolute using [1-3] bits / subband
    - Layer granularity:
      - Same amplitude for all layers
      - Different amplitude for each layer
  - TBD: if quantization granularity/bits vary per layer and/or per beam
  - TBD: if amplitude and phase are jointly encoded

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Updated version in: R1-1611018 **Way Forward for Quantized Advanced CSI Feedback Structure Ericsson, Huawei, HiSilicon, ZTE, ZTE Microelectronics, CATT, Qualcomm**

Conclusion: More discussion is needed. Email discussion for considering the above two proposals and any possible refinement/updates/merging (including the revised way forward in R1-1611018), Samsung as moderator until October 27th

Not treated.

R1-1608682	Discussion on design of linear combination codebook	ZTE, ZTE Microelectronics
R1-1608724	Considerations on advanced CSI reporting	CATT
R1-1608726	Codebook design for advanced CSI reporting	CATT
R1-1609013	Linear combination W2 codebook	Samsung
R1-1609014	Rank 2 linear combination codebook	Samsung
R1-1609193	Performance evaluation on linear combination based CSI	LG Electronics
R1-1609440	Analysis on orthogonal/non-orthogonal basis for advanced CSI feedback	Huawei, HiSilicon
R1-1609463	On beam combining codebook for Class B FD-MIMO	Intel Corporation
R1-1609464	Discussion on advanced CSI feedback	Intel Corporation
R1-1609855	Phase and amplitude vs. phase only beam combining for advanced CSI reporting	Ericsson
R1-1609856	Performance of Advanced CSI with 4 & 8 Tx Antennas	Ericsson
R1-1609857	Support of advanced CSI for CLASS B	Ericsson
R1-1609922	Advanced CSI feedback for Class B	Huawei, HiSilicon
R1-1610101	Performance evaluation of explicit CSI feedback	InterDigital Communications
R1-1610758	Overhead Comparison Between Class-A-Based and Unrestricted Orthogonal Designs	Samsung
R1-1610762	Way Forward on further details in Advanced CSI	Huawei
R1-1610781	Performance of Advanced CSI with 4 and 8 TX antennas	Ericsson

7.2.2.1.2 Interference measurement

R1-1610029	**MU interference measurement and MU-CQI enhancement**	**NTT DOCOMO, INC.**
R1-1609291	**Enhancing interference measurement for MU transmissions**	**CMCC**
R1-1608725	**Aperiodic CSI-IM for interference measurement enhancement**	**CATT**
R1-1609965	**Discussion on interference measurement enhancements**	**Qualcomm Incorporated**
R1-1609860	**On need of interference measurement enhancement in Rel-14**	**Ericsson**

Conclusions:

- Companies that have provided simulation results have shown benefits from a variety of interference measuremet enhancements; no consensus on the size of the benefits of interference measurement enhancements, or on which enhancements might be worth considering further.
- No interference measurement enhancements will be specified in Release 14, unless consensus emerges on a proposal that can be agreed with less than 5 minutes of online meeting time.
- Companies are encouraged to discuss the following WFs offline for possible future consideration in a later Release:

Not treated.

R1-1608598	Interference measurement enhancement in LTE Rel-14	Huawei, HiSilicon
R1-1608683	Discussion on interference measurement for MU-CSI	ZTE, ZTE Microelectronics
R1-1609015	Discussions on enhanced interference measurement based on NZP CSI-RS	Samsung
R1-1609016	Discussion on enhanced MU interference measurement based on DMRS	Samsung
R1-1609017	Discussions on enhanced interference measurement based on aperiodic IMR	Samsung
R1-1609547	Interference measurement and reporting for MU transmission in FD-MIMO	ASTRI, TCL
R1-1610603	WF on MU-CQI Enhancement	NTT DOCOMO, Qualcomm, Samsung, NEC, Xinwei
R1-1610763	Way Forward on NZP CSI-RS based interference measurement	Huawei, HiSilicon
R1-1610771	Way Forward on interference measurement enhancement	CATT, Samsung, CATR, ITRI, InterDigital, KT, KDDI, LG Electronics, ZTE, Xinwei

7.2.2.1.3 Feedback mechanism enhancement

Including analog feedback, use of PUCCH format 3, and others

R1-1608599	Uplink channel design for quantized/un-quantized channel representation	Huawei, HiSilicon
R1-1608684	Feedback mechanism for linear combination based CSI	ZTE, ZTE Microelectronics
R1-1609018	Discussions on periodic CSI reporting for class A in eFD-MIMO	Samsung
R1-1609194	Discussion on feedback mechanism enhancement for advanced CSI	LG Electronics
R1-1609858	Feedback Mechanisms for Advanced CSI	Ericsson
R1-1609859	Draft LS on Support for Advanced CSI Reporting in Higher Layer Signaling	Ericsson

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R1-1609966 Discussion on analog CSI feedback Qualcomm Incorporated
R1-1610030 On feedback enhancements to support advanced CSI NTT DOCOMO, INC.

7.2.2.1.4 Non-precoded CSI-RS codebook for 20 – 32 ports

R1-1609851 Email summary: [86-14] FD-MIMO Port Layouts and Oversampling Factors Ericsson

Strive to conclude on (N1,N2,O1,O2) combinations for Class A reporting in RAN1#86b, starting from the proposal of R1-168511. Further discuss the following, addressing if and how complexity is impacted and considering performance:

1. The necessity of 3 oversampling factors
2. Why we need both N1>=N2 and N2>=N1 combinations

R1-1610560 Way Forward on Antenna Port Layouts and Oversampling Factors Ericsson, Sprint, Verizon, DOCOMO, Deutsche Telekom, ATT, Samsung

Agreement:

- Agree on all (N1, N2) combinations on slide 4 of R1-1010560
- Agree on the following table for (O1, O2) combinations (Alt1 of the left table on slide 4 of R1-1610560)

Number of CSI-RS antenna ports, P	(N_1, N_2)	(O_1, O_2) :
20	(2,5)	(8,4)
	(5,2)	(4,4)
	(10,1)	(4,-)
24	(2,6)	(8,4)
	(3,4)	(8,4)
	(4,3)	(4,4)
	(6,2)	(4,4)
	(12,1)	(4,-)
28	(2,7)	(8,4)
	(7,2)	(4,4)
	(14,1)	(4,-)
32	(2,8)	(8,4)
	(4,4)	(8,4)
	(8,2)	(4,4)
	(16,1)	(4,-)

R1-1610942 WF on A codebook enhancements Qualcomm, LG Electronics, Xinwei
Conclusion: no consensus on WF proposed in R1-1610942

Conclusion: The need for extending design principles of Rel.13 Class A codebooks with {20, 24, 28, 32} ports is to be decided in RAN1#87.

Not treated.
R1-1608685 Port layout and Class A codebook design for 20-32 ports ZTE, ZTE Microelectronics
R1-1608727 Non-precoded CSI-RS codebook for 20-32 ports CATT
R1-1608926 Codebook Design for Class A CSI Reporting up to 32 Ports Nokia, Alcatel-Lucent Shanghai Bell
R1-1609019 Class A codebook extension and enhancement Samsung
R1-1609195 Discussion on Class A codebook for eFD-MIMO LG Electronics
R1-1609465 Beam broadening for more than 16 antenna ports Intel Corporation
R1-1609852 Performance comparison of different antenna port layouts Ericsson
R1-1609967 Non-precoded CSI-RS Codebooks for 20-32 ports Qualcomm Incorporated
R1-1610940 Codebook design for up to 32 CSI-RS ports Huawei, HiSilicon

7.2.2.2 Open-loop and Semi-open-loop

R1-1608927 DMRS-based Semi-open Loop Schemes for Rank 1 Transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-1609020 Discussions on semi-open-loop transmission in eFD-MIMO Samsung
R1-1609021 Simulation results for precoder cycling based on semi-open-loop transmission Samsung
R1-1609968 DMRS based semi-OL Transmission schemes and CSI reporting Qualcomm Incorporated
R1-1609196 Discussion on OL and Semi-OL MIMO LG Electronics
R1-1609862 Semi-Open Loop Transmission Scheme Ericsson
R1-1609928 DMRS based semi-open loop transmission Huawei, HiSilicon

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R1-1610592 WF on transmission scheme for semi-open loop CATT, Samsung, Nokia, Alcatel-Lucent Shanghai Bell, Intel

Revised in R1-1610598.

Agreements:

- Denote the modulation symbol index as *i*, RE-level PDSCH processing for semi-open-loop MIMO is based on DMRS ports 7/8
  - Rank-1: Tx diversity
    - $\begin{bmatrix} y^{(7)}(2i) \\ y^{(7)}(2i) \\ y^{(8)}(2i+1) \\ y^{(8)}(2i+1) \end{bmatrix} = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 0 & j & 0 \\ 0 & -1 & 0 & j \\ 0 & 1 & 0 & j \\ 1 & 0 & -j & 0 \end{bmatrix} \begin{bmatrix} \mathrm{Re}(x^{(0)}(i)) \\ \mathrm{Re}(x^{(1)}(i)) \\ \mathrm{Im}(x^{(0)}(i)) \\ \mathrm{Im}(x^{(1)}(i)) \end{bmatrix}$
  - Rank-2: co-phasing cycling
    - $\begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ \varphi_n & -\varphi_n \end{bmatrix} \begin{bmatrix} x^{(0)}(i) \\ x^{(1)}(i) \end{bmatrix}, \ \varphi_n = e^{j\pi \bmod(i,2)/2}$
- For the purpose of CSI feedback, UE assumes the following beamforming on port 7/8 (to N CSI-RS ports)
  - Dual-stage codebook: W(j)= W1W2(j)
    - W1: wideband i1 (e.g. grid of beams) of rank-2
    - Rank-1 (options to be downselected at RAN1#87):
      - Option 0: SFBC without defined cycling pattern (e.g. codebook subset restriction applicable to i2, and/or hybrid A+B CSI (with second eMIMO type associated with single-stage codebook), and/or Class B)
      - Option 1: SFBC only + fixed beam selection
      - Option 2: SFBC + per-N-PRB-pair cycling with defined cycling pattern
        - W2(j): pre-determined set of beam selection matrices of rank-2
          - W2(j) cycling per PRG, where PRG comprises N consecutive PRB pairs
          - value of N FFS
          - size/order of beam selection matrices for cycling FFS
    - Rank-2 (options to be downselected at RAN1#87)
      - Option 0: without defined cycling pattern (e.g. codebook subset restriction applicable to i2, and/or hybrid A+B CSI (with second eMIMO type associated with single-stage codebook), and/or Class B)
      - Option 1: fixed beam selection
      - Option 2: per-N-PRB-pair cycling with defined cycling pattern
        - W2(j): pre-determined set of beam selection matrices of rank-2
          - W2(j) cycling per PRG, where PRG comprises N consecutive PRB pairs
          - value of N FFS
          - size/order of beam selection matrices for cycling FFS
  - If the CQI reporting is configured to be based on the Single-stage codebook: W(j)
    - 2 CSI-RS ports: identify matrix (i.e. no PMI feedback)
    - 4 CSI-ports: Per-PRB-pair cycling of W(j), where W(j) = C_k, k=mod(j,4)+12, C_k denotes the rank-2 precoding matrix of index k
  - NOTE: j denotes PRB pair index
  - FFS rank-3/4

R1-1610613 WF on CSI feedback for DMRS open loop transmission Huawei, HiSilicon, CATT

Proposal:

- For Class A in case of semi-open-loop operation, two CSI reporting types for dual stage codebook are supported including
  - Type A: i1, CQI, RI
  - Type B: i1, CQI, RI and subsampled i2,
    - FFS: detailed i2 subsampling
  - Type A or Type B is configured by RRC signalling

Conclusion: No consensus.

Not treated.

R1-1608686 Enhancements for DMRS-based Semi-Open-Loop Transmission ZTE, ZTE Microelectronics
R1-1608728 CSI feedback and PDSCH transmission for open-loop MIMO CATT
R1-1609466 Discussion on open loop and semi-open loopIntel Corporation

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R1-1609861 Details of Semi-Open Loop Transmission Ericsson
R1-1610031 Semi-open-loop MIMO with beamformed CSI-RS NTT DOCOMO, INC.
R1-1610303 Evaluations on DMRS based open and semi-open loop MIMO schemes CEWiT
R1-1610598 WF on transmission scheme for semi-open loop CATT

7.2.2.3 UL DMRS

R1-1609197 Remaining details on UL DMRS enhancement LG Electronics
R1-1609467 Discussion on UL DM-RS with IFDMA structure Intel Corporation
R1-1609849 On RPF, Control Signalling, and Power Boosting for UL DMRS Ericsson
R1-1608928 Remailing details of UL DMRS Base Sequences with IFDMA Nokia, Alcatel-Lucent Shanghai Bell
R1-1609850 On new UL DMRS sequences of lengths 6, 18 and 30 Ericsson
R1-1609925 Discussion on DMRS sequence design Huawei, HiSilicon

R1-1610591 WF on UL DMRS Nokia, Alcatel-Lucent Shanghai Bell, NEC

Agreements:

- IFDMA details
  - IFDMA DMRS with RPF=2 only will be supported in Rel-14
  - Lengths of 6, 18 and 30 DMRS based sequences are supported for RPF=2
    - Length-30 base sequence is FFS until RAN1#87 (e.g. Table 6 in R1-1609850)
    - Length-18 base sequences design refer Table 3 in R1-1608928
    - Length-6 base sequence design refer to Table 4 in R1-1609850
  - Additional 3dB power boosting is used for IFDMA DMRS with RPF=2
- Cyclic Shift of UL IFDMA DMRS Generation:
  - If IFDMA is activated according to control signaling,
    - reference signal sequence on even subcarriers is $r_{u,v}^{(\alpha)}(n) = e^{j\alpha n}\bar{r}_{u,v}(n), \quad 0 \le n < M_{\text{sc}}^{\text{RS}}$
    - reference signal sequence on odd subcarriers is $r_{u,v}^{(\alpha)}(n) = e^{j\frac{\alpha}{2}} e^{j\alpha n}\bar{r}_{u,v}(n), \quad 0 \le n < M_{\text{sc}}^{\text{RS}}$
      - where $M_{\text{sc}}^{\text{RS}} = mN_{\text{sc}}^{\text{RB}}/2$ is the length of the reference signal sequence, where $1 \le m \le N_{\text{RB}}^{\max,\text{UL}}$ and $n_{\text{cs},\lambda} = \left(n_{\text{DMRS}}^{(1)} + n_{\text{DMRS},\lambda}^{(2)} + 2n_{\text{PN}}(n_{\text{s}})\right) \bmod 12$.

FFS until RAN1#87:

- Comb hopping is supported including inter-slot hopping and inter-subframe hopping
  - Inter-slot comb hopping is dynamically indicated by UL DCI.
    - FFS on details of signalling design.
  - Inter-subframe comb hopping, applying to initial transmissions and retransmissions and SPS, can be semi-statically configured by RRC signalling
  - Support of both inter-slot and inter-subframe comb hopping is not precluded
- Companies are encouraged to bring system level simulations to RAN1#87 to show the gain of comb hopping.

Conclusion: CS/OCC/IFDMA Mapping Table:

- Down-select at RAN1#87 one solution from the two candidates on slides 6 & 7 in R1-1610591, or the table below Proposal 3 in R1-1608603, for joint CS/OCC/IFDMA indication
  - Note: if intra-subframe Comb hopping is supported, comb id or IFDMA configuration in the tables refers to comb id in slot #0 for two slots of a subframe. FFS comb id in the slot #1.

R1-1610611 WF on RPF4 support for UL DMRS Huawei, HiSilicon, Nokia, ASB

R1-1610612 WF on sequence collision for UL DMRS Huawei, HiSilicon

Proposal:

- Root sequence index for DMRS with RPF=2 is determined with 4*q, wherein, q is the root sequence index of legacy DMRS sequence in the cell.

Conclusion: no consensus.

R1-1608603 Downlink control signaling design to support IFDMA based DMRS Huawei, HiSilicon

Not treated.
R1-1608602 On IFDMA based DMRS design Huawei, HiSilicon

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R1-1608687	Discussion on UL DMRS enhancement for eFD-MIMO	ZTE, ZTE Microelectronics
R1-1608729	Consideration on UL DMRS enhancements	CATT
R1-1608929	Control Signaling Design for UL DMRS with IFDMA	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609022	Further discussion on UL DMRS enhancement for eFDMIMO	Samsung
R1-1609148	Discussion on backward compatibility for IFDMA based scheme	NEC
R1-1609848	On Cyclic Shifts for UL DMRS with IFDMA	Ericsson
R1-1609969	Remaining details on uplink DMRS enhancements for FD-MIMO	Qualcomm Incorporated
R1-1610570	Way forward on IFDMA based DMRS	Intel, Qualcomm
R1-1610597	WF on downlink control signaling for IFDMA based DMRS	Huawei, HiSilicon

7.2.2.4 Non-precoded CSI-RS

R1-1609970	**Non-precoded CSI-RS design for up to 32 ports**	**Qualcomm Incorporated**
R1-1608600	**Discussion on non-precoded CSI-RS up to 32 CSI-RS ports**	**Huawei, HiSilicon**
R1-1609842	**Remaining details on aggregation of CSI-RS configurations**	**Ericsson**

R1-1610595 WF on Nk and Mk for 20 and 28 port CSI-RS Samsung, LGE, CATT, Nokia, ASB, InterDigital, Intel

Agreement:
- For {20, 28} ports, $\Sigma_k M_k \in \{20, 28\}$, $M_k = 4$, where M_k is the same for all k
  - At least for CDM-4

Qualcomm and ZTE note that this agreement implies that port sharing with Rel-12/13 UEs is not supported.

R1-1610593 WF on aggregation for non-precoded CSI-RS ZTE, ZTE Microelectronics, Qualcomm

Proposal:
- For {20, 28} ports, $\sum_k M_k \in \{20, 28\}$, $M_k \in \{4, 8\}$, where M_k can be different for different k at least for CDM-4
  - FFS port indexing

R1-1610596 WF on CSI-RS design for CDM 4 and CDM 8 LG Electronics, Ericsson, Qualcomm, CATT

Agreement: Working Assumption is confirmed that CDM8 is supported for {24,32} port CSI-RS

R1-1610741 WF on CSI-RS design for CDM-4 and CDM-8 LG Electronics, Ericsson, Qualcomm, CATT, Samsung

Agreements:
- For 20-, 24-, 28-, and 32-port CSI-RS, when CDM-4 OCC applies in the CDM group comprising 4 REs within k-th CSI-RS configuration, according to the table below.
  - For N_k=4, 4REs mapping to legacy 4-port CSI-RS comprises a CDM group.
  - For N_k=8, 8 REs mapping to legacy 8-port CSI-RS are partitioned into two groups of 4 REs, and each group of 4 REs located adjacently comprises a CDM group:



  - 

OCC index	OCC on REs [a b c d]
0	[1 1 1 1]
1	[1 -1 1 -1]
2	[1 1 -1 -1]
3	[1 -1 -1 1]

- FFS on additional CDM-4 pattern(s) at least for 28- and 32-port to support full power utilization within a single PRB.
- CDM-8 design for {24, 32} ports:
  - At least for 32-port CSI-RS, at least one CDM-8 pattern exists which uses REs from more than 2 OFDM symbols
  - FFS until RAN1#87:

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- which CDM-8 patterns are useful, and
- downselection between:
  - Alt 1: CDM-8 patterns are configured by aggregation of CDM-2/4 patterns
  - Alt 2: CDM-8 patterns are defined in the specifications without explicit aggregation

- Overhead reduction for CDM-8 is FFS
- Note: CDM-8 can be supported in both normal and special subframes

R1-1610623 WF on CSI-RS density values for Class A Ericsson, LG

Agreement:

- For Class A eFD-MIMO, a CSI-RS density value of 1/3 is supported in addition to already agreed values of 1 and ½
- No other values of CSI-RS density are supported in this Release.

R1-1610624 WF on CSI-RS overhead reduction for Class A Ericsson, Samsung

Agreement:

- For Class A, CSI-RS overhead reduction is supported by Comb-like transmission, allowing PDSCH transmission in the REs in PRBs with no CSI-RS ports
  - UE measures channel in REs in PRBs with CSI-RS ports and expects PDSCH in PRBs with no CSI-RS ports

R1-1610594 WF on signalling details for CSI-RS overhead reduction Samsung, ZTE, Ericsson, DoCoMo, InterDigital

Revised in R1-1610602

Agreements:

- For Class B NZP CSI-RS:
  - Support CSI-RS density of d ∈ {1,1/2} RE/RB/port
  - Additional values of d=1/3 and/or 1/8 are not precluded for Class B if significant benefit can be shown at RAN1#87.
- Transmission and/or measurement comb offsets are 0..1/d-1
  - For d=1/2 (i.e. for Class A & Class B), comb offsets ∈ {0, 1} can be configured for CSI-RS transmission and/or measurement in the n-th PRB, where n mod 2 = comb offset
  - For d=1/3 (i.e. at least for Class A), comb offsets ∈ {0, 1, 2} can be configured for CSI-RS transmission and/or measurement in the n-th PRB, where n mod 3 = comb offset
- Working Assumption: For Class A NZP CSI-RS with more than 16 CSI-RS port, in a given CSI-RS resource all CSI-RS configurations have the same values of *d*
  - Will be confirmed automatically at RAN1#87 unless there is consensus to support different values of *d* per CSI-RS configuration
- For Class A NZP CSI-RS with more than 16 CSI-RS ports each CSI-RS configuration can have different values of comb offset
- FFS the detailed signalling design

R1-1610718 WF on the overhead reduction for Class B CSI-RS Intel

Proposal:

- For Class-B eMIMO type and CSI-RS resource with two or more antenna ports with *alternativeCodebookEnabledCLASSB_K1=True*, the channel measurements obtained from CSI-RS antenna ports are renumbered for CSI calculation according to the following equation:

$$p = \begin{cases} 15+i & \text{for } p' \in \{15,\ldots,15+2i\} \\ 15+i+\dfrac{N_{\text{ports}}^{\text{CSI}}}{2} & \text{for } p' \in \{16,\ldots,15+2i+1\} \end{cases}$$

$$i = \{0,1,\ldots,\frac{N_{\text{ports}}^{\text{CSI}}}{2}-1\}$$

- CSI-RS antenna ports of CSI-RS resource can be transmitted in different PRBs
- Signalling details of PRB density and PRB offsets for antenna ports are FFS

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Not treated.

R1-1608688	Further discussion on non-precoded CSI-RS design for eFD-MIMO	ZTE, ZTE Microelectronics
R1-1608689	Aperiodic CSI-RS for non-precoded CSI-RS	ZTE, ZTE Microelectronics
R1-1608730	Enhanced non-precoded CSI-RS with CDM-8	CATT
R1-1608731	Enhanced non-precoded CSI-RS with CDM-2/4	CATT
R1-1608732	Density reduction for class A CSI-RS with 20-32 ports	CATT
R1-1608930	Considerations of Non-precoded CSI-RS for Class A	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609023	Discussions on non-precoded CSI-RS port numbering	Samsung
R1-1609024	Discussions on CDM-4/-8 for non-precoded CSI-RS	Samsung
R1-1609149	Proposals for CSI-RS with CDM4	NEC
R1-1609150	Proposals for CSI-RS with CDM8	NEC
R1-1609198	Remaining details on Non-precoded CSI-RS	LG Electronics
R1-1609468	Remaining details on NZP CSI-RS for Class A FD-MIMO	Intel Corporation
R1-1609840	Frequency domain measurement restriction for reduced overhead NZP CSI-RS	Ericsson
R1-1609841	On Supported CSI-RS Density Values for Class A in eFD-MIMO	Ericsson
R1-1609843	CDM-8 for NZP CSI-RS	Ericsson
R1-1609885	Non-precoded CSI-RS design for eFD-MIMO	Potevio
R1-1610032	Low-density CSI-RS and port sharing	NTT DOCOMO, INC.

7.2.2.5 Other remaining issues

7.2.2.5.1 Aperiodic and frequency domain reduced overhead CSI-RS

Activation/release mechanism

R1-1610635 WF on Aperiodic CSI-RS for eFD-MIMO Samsung, CATT, LG Electronics, Nokia, Alcatel-Lucent Shanghai Bell, ZTE, ZTE Microelectronics, InterDigital, Xinwei, Huawei, HiSilicon, KT Corporation, AT&T, Mitsubishi Electric, Straight Path, Qualcomm

Agreements:

- For activation/release mechanism:
  - MAC CE is used to signal the choice of N out of K RRC-configured CSI-RS resources
    - The value of N is configurable via higher-layer signalling and upper bounded by a UE capability parameter Nmax
      - Nmax for aperiodic and multi-shot periodic CSI-RS can be different.
    - When $K \leq 2$, $N=K$; else (when $K > 2$) $N = \{1, 2, \ldots, \min(4,K)\}$
      - Note: If the above value of N exceeds Nmax, N = Nmax is used instead.
      - Note: Activation/release mechanism is skipped for aperiodic CSI-RS when $K = 1$ or N
- The above MAC-CE-based activation/release mechanism is used for both aperiodic and "multi-shot" CSI-RS.

R1-1610941 WF on MAC CE based activation/release mechanism Qualcomm

Agreements:

- Down select the value for X/Y for MAC CE based activation/release mechanism from (RAN1#87)
  - Alt1. X=Y=4 ms
  - Alt2. X=Y=8 ms
  - Note: For both aperiodic and "multi-shot" CSI-RS

R1-1610615 WF on supporting aperiodic CSI-RS with one resource Huawei, HiSilicon

QCL

R1-1610732 WF on QCL issue for aperiodic CSIRS LG Electronics, Samsung

Proposal:

- For QCL indication on DMRS to aperiodic CSIRS or multi-shot CSIRS,
  - UE is not expected that aperiodic CSIRS is indicated in PQI for QCL purpose with DMRS
  - Multi-shot CSIRS can be indicated in PQI for QCL purpose, and follow legacy QCL assumption.

Conclusion: More discussion is needed over email - moderator (LGE) until October 20th

Rate Matching

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R1-1610924 WF on remaining details on PDSCH rate matching LG Electronics, InterDigital, Qualcomm, ZTE, ZTE Microelectronics

Proposal:

- For PDSCH rate matching on aperiodic CSI-RS and multi-shot CSI-RS, X-bit (X=1 or 2) aperiodic ZP CSI-RS resource signaling field is introduced in DL-related DCIs for all TMs
  - AP ZP CSIRS resource configuration is defined without subframe_config
  - UE conducts PDSCH rate matching on AP ZP CSIRS at the subframe when the DCI is signaled.
  - If X=1 and only AP ZP CSI-RS resource configuration is configured by RRC, AP ZP CSI-RS resource signaling field descriptions are
    - State '0': No configured AP ZP CSIRS is indicated.
    - State '1': The 1st RRC-configured AP ZP CSIRS is indicated to be applied.
  - If X=1 and more than 1 AP ZP CSI-RS resource configurations are configured by RRC, the above State '1' description is given/activated via MAC CE, choosing one out of the configured AP ZP CSI-RS resource configurations.
  - If X=2 and up to 3 AP ZP CSI-RS resource configurations are configured by RRC, AP ZP CSI-RS resource signaling field descriptions are
    - State '0': No configured AP ZP CSIRS is indicated.
    - State '1': The 1st RRC-configured AP ZP CSIRS is indicated to be applied.
    - State '2': The 2nd RRC-configured AP ZP CSIRS is indicated to be applied.
    - State '3': The 3rd RRC-configured AP ZP CSIRS is indicated to be applied.
  - If X=2 and more than 3 AP ZP CSI-RS resource configurations are configured by RRC, the above 3 non-zero state descriptions are given/activated via MAC CE, each choosing one out of the configured AP ZP CSI-RS resource configurations.
- ZP CSI-RS resource configuration with 1ms periodicity is configured for EPDCCH by higher layer, and considered as EPDCCH available REs and punctured.

Conclusion: More discussion is needed over email - moderator (LGE) until October 20th

DCI signalling

R1-1610815 WF on aperiodic CSI-RS selection Ericsson, NTT DOCOMO

Conclusion:

- 3 alternatives are identified:
  - Alt1 Reuse A-CSI request field and add more bit(s) if necessary
  - Alt2 Reuse CS field (see R1-1610815, R1-1610816)
  - Alt3 Add ceil(log2(N))-bit or 2-bit DCI field
- Decide between the above 3 alternatives over email discussion, moderator (Ericsson) until October 27th

Not treated.

R1-1608601	Enhancement on rate matching for different transmission modes	Huawei, HiSilicon
R1-1608690	Remaining issues on aperiodic CSI-RS	ZTE, ZTE Microelectronics
R1-1608733	Remaining issues on aperiodic CSI-RS	CATT
R1-1608734	PDSCH rate-matching for aperiodic CSI-RS	CATT
R1-1608735	Density reduction for beamformed CSI-RS	CATT
R1-1608736	On QCL for aperiodic CSI-RS	CATT
R1-1608931	Remaining Details of aperiodic CSI-RS and overhead Reduction	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609025	Discussions on remaining details of rate matching and QCL for aperiodic and multi-shot CSI-RS	Samsung
R1-1609026	Completing aperiodic and "multi-shot" CSI-RS for Rel.14	Samsung
R1-1609199	Remaining details on beamformed CSI-RS enhancement	LG Electronics
R1-1609407	Discussion on frequency domain reduced overhead CSI-RS	ITRI
R1-1609469	Remaining details on overhead reduction for Class B CSI-RS	Intel Corporation
R1-1609844	Mechanism for Class B overhead reduction	Ericsson
R1-1609845	Remaining details of Aperiodic and Multi-shot CSI-RS	Ericsson
R1-1609846	On Rate Matching for Beamformed CSI-RS	Ericsson
R1-1609847	QCL for Multi-Shot or Aperiodic CSI-RS	Ericsson
R1-1609923	Support of multi-shot CSI-RS	Huawei, HiSilicon
R1-1609924	Support of aperiodic CSI-RS	Huawei, HiSilicon
R1-1609971	Discussion on activation and release mechanism for beamformed CSI-RS	Qualcomm Incorporated
R1-1609972	Remaining details on aperiodic CSI-RS	Qualcomm Incorporated
R1-1610033	Discussion on Resource Sharing of Beamformed CSI-RS	NTT DOCOMO, INC.

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R1-1610102	CSI-RS overhead reduction	InterDigital Communications
R1-1610104	A-CSI-RS Impacts on EPDCCH	InterDigital Communications
R1-1610105	PDSCH rate-matching for A-CSI-RS	InterDigital Communications
R1-1610365	Discussion multi-shot CSI-RS	Intel Corporation
R1-1610632	Way Forward on PDSCH rate matching for supporting aperiodic CSIRS	LGE
R1-1610816	On PHICH collision analysis	Ericsson

7.2.2.5.2 Hybrid CSI

Mechanism "2"?

R1-1610786 Way Forward on Hybrid CSI Mechanism ZTE, ZTE Microelectronics, NTT DOCOMO, Ericsson, Intel

Proposal:

- For hybrid CSI in one CSI process, support CLASS B with K>1 CSI-RS resources for the 1st eMIMO-Type and CLASS B with K=1 CSI-RS resource for the 2nd eMIMO-Type
  - For the 1st eMIMO-Type
    - CRI (without CQI/PMI/RI) is reported
  - For the 2nd eMIMO-Type
    - CQI/PMI/RI are reported
  - Different CSI-RS resources and/or eMIMO-Types can be used for PUCCH and PUSCH
  - UE calculates one CSI report for only one eMIMO-Type of a pair at a time

Conclusion: More discussion is needed over email - moderator (NTT DOCOMO) until October 20th

R1-1611013 WF on Remaining Issues for Hybrid CSI Samsung, Ericsson

Agreements:

- Confirm working assumption for mechanism 1:
  - No inter-dependence between CSI calculations across two eMIMO-Types
  - Note: ZTE has a concern on this.

Conclusion: More discussion is needed on the proposal below. If the use of PF-3 (e.g. the proposal below) cannot be agreed by RAN1#87 (Reno), the use of PF-2 will be agreed.

- Use PUCCH format 3 (PF-3) for CSI reporting of 1st eMIMO-Type
  - A PF-3 resource is allocated for CSI reporting and/or A/N
- PF resource usage follows legacy-like procedures as follows:
  - For N≥1 CC(s):
    - CSI-only reporting: Use PF-3 resource allocated for CSI
    - A/N-only: If A/N is for Pcell only, use PF-1A/1B resource allocated for A/N. Otherwise use PF-3 resource allocated for A/N
    - CSI and A/N collision: multiplex CSI and A/N using PF-3 resource allocated for A/N
      - For TDD scenario, the DAI is set to be 1 (i.e. PF-1A/B is used only if for PCell and DAI in DCI format is the first DAI with value 1 that the UE detects)

R1-1610731 WF on PUSCH CSI reporting for hybrid CSIRS mechanism 1 LG Electronics, Samsung, Qualcomm

Conclusion: More discussion is needed to choose between the following two alternatives. Email discussion – moderator (Samsung) until October 27th

Alt1. Proposal in R1-1610731

- For aperiodic CSI reporting for hybrid CSIRS mechanism 1
  - Either one of CSI for 1st eMIMO-Type (i.e., 1st CSI) and CSI for 2nd eMIMO-Type (i.e., 2nd CSI) is triggered for aperiodic CSI reporting
    - CSI request field in UL grant DCI is used to indicate either one of the two. FFS whether additional bit(s) are needed
  - For 1st eMIMO-Type, encoding mechanism/mapping on PUSCH is FFS.
  - For 2nd eMIMO-Type, legacy CSI encoding/mapping on PUSCH is reused.

Alt2. Report both eMIMO-Types, but the UE is only required to update one of the two eMIMO-Types

- Example a: A method analogous to Rel.13 CSI relaxation
- Example b: cf. R1-1609853 section 2.2.2. For this solution, the reference resource definition for the 1st eMIMO-Type needs to be changed. There might be some impact on UE behaviors.

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- [R1-1609853] "When periodic CSI is not configured for the first eMIMO-Type, its reference resource is in the subframe containing its most recent CSI-RS resource
  - Otherwise, the reference resource for the first eMIMO-Type is that set by periodic CSI"

Conclusion: Email discussion on the proposal below, moderator Hao until October 27th

- Regardless of which alternative is chosen, 1st and 2nd eMIMO-Types can be configured for PUCCH and PUSCH, respectively.

Not treated.

R1-1608691	Remaining issues on Hybrid CSI	ZTE, ZTE Microelectronics
R1-1608737	On remaining issues on hybrid CSI-RS	CATT
R1-1608932	Remaining Details of Hybrid CSI Reporting	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609027	Partial port hybrid CSI reporting	Samsung
R1-1609200	Remaining details on Hybrid CSI-RS	LG Electronics
R1-1609853	Generalized Hybrid CSI Reporting	Ericsson
R1-1609927	Discussion on Hybrid CSI reporting	Huawei, HiSilicon
R1-1609973	Remaining details on CSI reporting for hybrid CSI-RS	Qualcomm Incorporated
R1-1610034	CSI Reporting for Hybrid CSI-RS	NTT DOCOMO, INC.
R1-1610364	Discussion on CSI reporting for hybrid CSI	Intel Corporation
R1-1610424	Completing mechanism 1 of hybrid CSI for Rel.14	Samsung
R1-1610764	Way Forward on extra scheme supported in hybrid CSI	Huawei

7.2.3 Downlink Multiuser Superposition Transmission for LTE - WID in RP-161019

R1-1610866 Chairman's notes of AI 7.2.3 on Downlink Multiuser Superposition Transmission for LTE Ad-Hoc chair (Qualcomm, MediaTek)

The document was presented by Wanshi Chen from Qualcomm.

Decision: The document is endorsed and content incorporated below.

7.2.3.1 Superposition transmissions

Power ratios

R1-1610802	**Discussion on power ratios for MUST Case 1&2 Huawei, HiSilicon**	(Revision of R1-1608604)
R1-1610304	**Super-constellation based power ratios and gray mapping for MUST**	**KT Corp.**
R1-1609615	**On the set of power ratios for MUST Case 1 and 2**	**Nokia, Alcatel-Lucent Shanghai Bell**

R1-1610724 Way Forward on Power Ratio in MUST Cases 1 and 2 MediaTek, ZTE, ZTE Microelectronics

Agreements

- For MUST Cases 1 and 2, the number of power ratios is
  - 3 for MOD combination of QPSK (MUST-near) + QPSK (MUST-far)
  - 3 for MOD combination of 16QAM (MUST-near) + QPSK (MUST-far)

Working assumption

  - 3 for MOD combination of 64QAM (MUST-near) + QPSK (MUST-far)

R1-1610714 Way Forward on Principle Generating Power Ratio ZTE, ZTE Microelectronics, LG Electronics
R1-1610803 Way Forward on downlink power allocation for MUST Case 1&2 Huawei, HiSilicon, NTT DOCOMO

Agreements:

- In case of MUST Case 1 operation, when MUST near UE is rank2 and MUST far UE is rank1 transmission, the two layers of MUST near UE have the same transmission power

R1-1610804 Way Forward on Power Ratios for Case 1 &2 Huawei, HiSilicon, Qualcomm
R1-1610948 Way Forward on Power Ratios for Case 1 &2 Huawei, HiSilicon, Qualcomm, Nokia, ASB

Agreements:

- The power ratios for different modulation combination are
  { 8/10, 50/58, 264.5/289} for QPSK+QPSK
  { 32/42, 144.5/167, 128/138} for 16QAM+QPSK
  {128/170, 40.5/51, 288/330} for 64QAM+QPSK
- Up to editor to how to capture the values in the specification

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Gray mapping
R1-1610723 Way Forward on Gray Mapped Composite Constellation in MUST MediaTek, Qualcomm, Nokia, ASB, ITRI
R1-1610754 Way Forward on Definition of Gray Mapped Composite Constellation ZTE, ZTE Microelectronics, LG Electronics
R1-1610805 Way Forward on Gray Conversion for MUST Case 1&2 Huawei, HiSilicon, ZTE, ZTE Microelctronics
R1-1610715 Way Forward on the Gray conversion LG Electronics, ZTE, ZTE Microelectronics

Agreement
- For MUST case 1 and case 2, specify the text to achieve Gray-mapped composite constellation for superposed users and it's up to editor to choose from the following references for specification
  - R1-1610723
  - R1-1610805

Not treated.
R1-1608678 MUST system performances with different power ratio choices ZTE
R1-1608679 Specification for Gray mapped composite constellation for MUST ZTE
R1-1609201 Discussion on power ratio and modulation order LG Electronics
R1-1609202 Discussion on Gray mapping for superposed constellation LG Electronics
R1-1609292 Views on MUST power ratio signaling CMCC
R1-1609353 Discussion on Gray conversion for MUST Case 1&2 Huawei, HiSilicon
R1-1609600 Gray mapped composite constellation of MUST MediaTek Inc.
R1-1609601 Power allocation for CRS based transmission schemes in MUST MediaTek Inc.
R1-1609616 On standardization of the composite constellations for MUST Case 1 and 2 Nokia, Alcatel-Lucent Shanghai Bell
R1-1609974 Superposition transmissions Qualcomm Incorporated
R1-1609975 Power ratio set considerations for MUST Qualcomm Incorporated
R1-1610040 Discussion on power ratios for MUST scheme NTT DOCOMO, INC.

7.2.3.2 Mechanisms for efficient operation

Related RRC signaling, DCI, UE assumptions, etc.

R1-1610725 Way Forward on DMRS based Transmission Scheme of MUST Case 3 MediaTek, ZTE, ZTE Microelectronics, CMCC
Continue offline till next meeting

R1-1610726 Way Forward on PDSCH Starting Symbol in MUST MediaTek, ZTE, ZTE Microelectronics, Nokia, ASB, ITRI, CMCC
Also supported by Huawei

Agreement: To cancel or suppress interfering PDSCH, MUST UE assumes the same starting OFDM symbol of interfering PDSCH as its own PDSCH

R1-1610729 WF on PDSCH starting symbol LG Electronics, Qualcomm
R1-1610830 WF on MUST control operation Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm
R1-1610947 WF on MUST control operation Nokia, Alcatel-Lucent Shanghai Bell, NEC
R1-1610730 WF on new DCI design LG Electronics, LG Uplus, MediaTek, ZTE, ZTE Microelectronics, Huawei, HiSilicon
Also supported by Sharp, Sony

Agreements:
- MUST operation with RA alignment of interference within near-UE allocation is supported for cases 1 and 2
  - single DCI by adding bits of wideband power ratio and interference presence in the self DCI is supported
- FFS case 3
- FFS MUST operation without RA alignment of interference within near-UE allocation is supported
  - two DCIs are supported
    - FFS on content of two DCIs
    - Aim for minimizing specification impact and reducing complexity

R1-1610809 Way Forward on MUST UE multiplexing Huawei, HiSilicon

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Further check whether R1-1610809 is already covered by R1-1610723, R1-1610805 and RP-160680 or not till next meeting

Not treated.

R1-1608605	DCI design for MUST Case 1&2	Huawei, HiSilicon
R1-1608680	Signaling design for MUST	ZTE
R1-1608738	Support of downlink superposition transmission	CATT
R1-1609144	New DCI design consideration for MUST	NEC
R1-1609203	Discussion on Signaling Assistance Information and remaining issues	LG Electronics
R1-1609293	On signaling design for MUST case 3	CMCC
R1-1609345	MUST UE multiplexing and resource allocation	Huawei, HiSilicon
R1-1609381	Discussion on DCI options for providing MUST-near UE co-schedule information	Sony
R1-1609566	DCI design for MUST Case 1 and Case 2	China Telecommunications
R1-1609602	On scheduling restrictions of MUST	MediaTek Inc.
R1-1609603	Fallback transmission mode of MUST	MediaTek Inc.
R1-1609617	On signaling for MUST CASE1/2/3	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609930	Discussion on power allocation issue for MUST Case 1&2	Huawei, HiSilicon
R1-1609976	Mechanisms for efficient operation	Qualcomm Incorporated
R1-1609977	MUST UE pairing with existing CQI feedback	Qualcomm Incorporated
R1-1610041	Discussion on remaining issues and signaling design for DL MUST	NTT DOCOMO, INC.

7.2.3.3 Evaluation for MUST using up to 8Tx

Focusing on Case 3 using up to 4Tx CRS-based TMs

R1-1608681	**Discussion and evaluation for MUST Case 3**	**ZTE**
R1-1609604	**System-level evaluation and design requirements for MUST Case 3**	**MediaTek Inc.**
R1-1609931	**Simulation results for MUST Case 3**	**Huawei, HiSilicon**

R1-1610806	**Way Forward on CRS-based MUST Case 3**	**Huawei, HiSilicon, LG Electronics**

Conclusion: There is no consensus in RAN1 to support Case 3 for CRS-based TMs

7.2.4 eMBMS enhancements for LTE - WID in RP-161297

R1-1610867 Chairman's notes of AI 7.2.4 on eMBMS enhancements for LTE Ad-Hoc chair (Nokia, Ericsson)

The document was presented by Matthew Baker from Nokia.

Decision: The document is endorsed and content incorporated below.

LS received in the course of the week:

R1-1610765 LS on RAN2 agreements on FeMBMS

7.2.4.1 Longer cyclic prefix for MBSFN subframe

R1-1609978 Design options for longer cyclic prefix and link level simulation results Qualcomm Incorporated

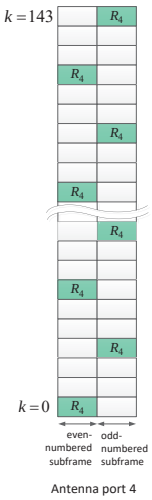
7.2.4.2 MBSFN-RS pattern for longer cyclic prefix

R1-1609676	**MBSFN reference signal design**	**Ericsson**
R1-1609979	**RS pattern for longer CP**	**Qualcomm Incorporated**
R1-1610310	**eMBMS RS Design Considerations**	**Nokia, Alcatel-Lucent Shanghai Bell**

Agreement:

- Confirm the working assumption from RAN1#86: CP length is 200us and core symbol duration of 800us
- Single RS pattern for this numerology:

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Note for minutes: Huawei has a strong concern that this limits flexibility for MBSFN subframe configuration and has poor support for mobility.

Agreement: There is a set of 8 MBSFN RS pseudo-random sequences for the Rel-14 longer-CP subframes.

7.2.4.3 Synchronization and acquisition of system information

R1-1609348 Considerations on increased number of MBSFN subframes Huawei, HiSilicon

R1-1609677 Synchronization and acquisition of system information for FeMBMS carrier Ericsson
R1-1609980 Initial acquisition and system information for eMBMS Qualcomm Incorporated
R1-1610311 eMBMS PSS/SSS/PBCH and SIB1 transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-1610358 System Information modification indication for FeMBMS carrier Ericsson

R1-1610927 Way Forward on eMBMS enhancement Ericsson, Qualcomm, BBC, Nokia, ASB, Intel, EBU, IRT, Dish

Agreements: For synchronization and acquisition of system information on FeMBMS carrier:

- For <100% MBSFN subframes the legacy sync and SI acquisition proceedures are reused based on subframe #0 and #5

Working Assumption: For synchronization and acquisition of system information on FeMBMS carrier:

- For 100% MBSFN subframe allocation FeMBMS carrier transmits a periodic subframe, CAS Cell Acquisition Subframe
  - To be confirmed or revisited at RAN1#87, including:
    - CAS performance (including synchronization performance and link level performance of PDCCH and PDSCH), and capacity analysis, based on the definitions below should be evaluated to the next meeting; details of SI transmission in different system bandwidths should also be provided.
    - Consideration of FDM as an additional mode of operation if all the details (i.e. design, guard band size, specification impact, UE implementation impact analysis) and evaluations showing clear performance benefit (considering the performance targets) are presented at the next meeting
- CAS supports PSS, SSS, CRS, PBCH, PDCCH, PDSCH (SI)
- CAS is always transmitted in subframe #0 with a period of 40ms
- MIB is provided by PBCH in every CAS
- The MIB transmitted in SFN mod 4 = 0 and can change only in SFN mod 16 = 0 and contains systemFrameNumber equal to the 6 most significant bits of the SFN
- SI is provided by PDSCH in CAS
- A first SI that may also contains scheduling of further SI is transmitted in SFN mod 8 = 0 and can change only in SFN mod 16 = 0
- This first SI may be a combination of SIBs, up to RAN2 agreements.
- MCCH change notification and SI modification notification are sent in PDCCH region of the CAS.
- FFS if from RAN1 perspective, it is feasible to transmit muiltiple SI messages in the same subframe by using different RNTIs. RAN2 may consider if this may be used.
- Inform RAN2 that SI modification notification can be conveyed to the UE with Direct Indication signalling.
- FFS enhancements on DCI to indicate larger allocation

Note that this Working Assumption is not based on complete performance evaluations. Complete performance evalutions are to be used in deciding whether to confirm or modify the working assumption at RAN1#87.

LS to be sent to RAN2 to inform them of the above agreements and Working Assumption - R1-1610605 - Alberto

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Friday
R1-1610605 [DRAFT] LS regarding agreements for FeMBMS Qualcomm
Decision: The document is noted and final LS is agreed in R1-1611051

R1-1609471 PBCH coverage enhancements for further enhanced MBMS carriers Intel Corporation
R1-1610312 Considerations on PBCH coverage enhancement Nokia, Alcatel-Lucent Shanghai Bell

7.2.4.4 Other

This includes potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes

R1-1609981 MBSFN subframes without a unicast control region and cell-specific reference signals Qualcomm Incorporated

Not treated.
R1-1609470 Potential CRS reductions for further enhanced MBMS carriers Intel Corporation
R1-1609678 CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes Ericsson
R1-1609982 Considerations on further CRS reduction Qualcomm Incorporated
R1-1610357 Unicast control region for FeMBMS carrier Ericsson

7.2.5 SRS Carrier Based Switching for LTE - WID in RP-160935

R1-1610868 Chairman's notes of AI 7.2.5 on SRS Carrier Based Switching for LTE Ad-Hoc chair (Huawei)
The document was presented by Weimin Xiao from Huawei.
Decision: The document is endorsed and content incorporated below.

R1-1610647 Way Forward on SRS Carrier-based Switching Huawei, HiSilicon, Softbank

Agreement:
- Send LS with agreements and RRC parameters to RAN2 and RAN4.
  - Content of LS and RRC parameters to be discussed.

Friday
R1-1611009 Draft LS for SRS Carrier-Based Switching Agreements Huawei
Decision: The document is noted and final LS is agreed in R1-1611049
R1-1611042 Draft LS on L1 parameters for SRS Carrier-Based Switching Huawei
Decision: The document is noted and final LS is agreed in R1-1611050

7.2.5.1 Procedures and configurations for SRS/RACH switching and transmission

Including details for selection of switching-from CC, maximum supported RF retuning time, and PHR

R1-1608586 Other considerations on SRS switching Huawei, HiSilicon
R1-1609472 On SRS transmission without PUSCH Intel Corporation
R1-1609683 Parameters for transmission of SRS in carrier based switching Ericsson

Agreement:
- Switching-from CC for a PUSCH-less CC
  - Option 1: rule(s) defined
    - E.g., descending order of CC index, but a CC with higher index may be more tightly coupled with the PCell
  - Option 2: RRC configuration
  - Agreed on option 2.

Note:
- UE is not expected to switch to a deactivated CC.
- For dual connectivity case, only switching within a cell group (MCG or SCG).

Agreement:
- UE may report RF retuning time no longer than X us
  - Option 1: X = 200
  - Option 2: X = 300
  - Option 3: X = 500
  - Option 4: X = 900

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- Adopt Option 3

Agreement:
- Switching for RACH
  - Switching-from CC: same as SRS and no additional configuration
  - Switching-to CC: based on PDCCH order

Agreement:
- PC parameter further clarifications: (remove subscript of SRS from f(i))
  - $P_{SRS,c}(i) = \min[\ P_{CMAX,c}(i),\ \{10\log_{10}(M_{SRS,c}) + P_{O\_SRS,c}(m) + \alpha_{SRS,c}\cdot PL_c + f_{SRS,c}(i)\}]$ [dB]
  - m=0 for P-SRS and m=1 for A-SRS on a PUSCH-less CC

Agreements:
- PHR
  - If SRS transmitted:
    $PH_{SRS,c}(i) = P_{CMAX,c}(i) - \{10\log_{10}(M_{SRS,c}) + P_{O\_SRS,c}(m) + \alpha_{SRS,c}\cdot PL_c + f_{SRS,c}(i)\}$ [dB]
  - Else:
    $PH_{SRS,c}(i) = \tilde{P}_{CMAX,c}(i) - \{P_{O\_SRS,c}(1) + \alpha_{SRS,c}\cdot PL_c + f_{SRS,c}(i)\}$ [dB]
- SRS
  - Through RRC configuration, allow SRS transmissions on more than 2 UpPTS symbols in the same subframe for the same UE, for A-SRS and P-SRS
    - On the same CC or multiple CCs
  - Allow more than one SRS configurations for the subframe, for A-SRS and P-SRS
    - Reuse existing SRS configurations (1 or 2 UpPTS symbols per SRS configuration)

Agreement:
- PRACH
  - No autonomous Re-Tx of PRACH if UE does not receive RAR
  - Re-transmission is achieved by monitoring PDCCH order
  - Power ramping up follows the current procedure

Not treated.

R1-1608585	Details on SRS switching-from CC and switching-to CC	Huawei, HiSilicon
R1-1608587	Power headroom report for SRS switching	Huawei, HiSilicon
R1-1609029	Configurations for SRS/RACH switching	Samsung
R1-1609344	Details on timing advance for SRS on TDD CCs without PUSCH	Huawei, HiSilicon
R1-1609684	UE reporting of interruption time for SRS in carrier based switching	Ericsson
R1-1609983	Details for SRS and PRACH switching and transmission	Qualcomm Incorporated

7.2.5.2 DCI design

Including details for group DCI design (jointly for TPC and A-SRS trigger), DL DCI design (for A-SRS trigger)

R1-1608588 DCI design for SRS switching Huawei, HiSilicon
R1-1609030 DCI for SRS Triggering and Power Control Samsung

Agreements:
- Group DCI for SRS switching
  - Payload same as 0/1A/3/3A
  - With 1 or more configured group RNTI for the newly introduced group DCI
  - A UE can be triggered for multiple CCs within one group DCI
    - Type A: A single field is used to trigger a group of (one or multiple) CCs if the UE is configured with more than 5 CCs without PUSCH
      - For all the CCs that are triggered by this field, each have a TPC field in this group DCI and the number of bits reserved is decided by the maximum group size among the configured groups
      - Maximum number of CCs of a group: 8
    - Type B: N fields are used to trigger up to N CCs if the UE is configured with less than or equal to 5 CCs without PUSCH
      - TPC field for each of the N CCs is also in this group DCI
  - Number of bits:
    - Trigger field:

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- 2 bits for triggering a group of CCs (type A)
- For triggering only single CC (type B),
  - 1 bit for single UL Tx antenna without antenna switching,
  - 2 bits for multiple UL Tx antenna including antenna switching
    - Per UE configured size
  - TPC: UE specifically configured 1 bit or 2 bits
- Search space
  - Common search space in Pcell
- Name of the new group DCI format: leave to the editor
- Also support TPC-only group DCI by not configuring the triggering field
  - UE is not expected to be configured with both TPC-only group DCI and the joint TPC and A-SRS trigger group DCI

- DL DCI formats for trigger
  - Reuse current DL DCI formats with SRS request field (currently 1A/2B/2C/2D)
  - 1 bit in DL DCI for SRS request

R1-1609473	Remaing details of SRS triggering with CC switching	Intel Corporation
R1-1609685	Power control for SRS carrier based switching	Ericsson
R1-1609882	Joint group DCI for SRS switching	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609984	DCI design	Qualcomm Incorporated

7.2.5.3 Details of collision handling

Including details for priority/dropping rules, mechanisms to mitigate the impact of collision (shortened PUSCH), and approaches to help avoid collision

Agreement:

- RRC signalling for HARQ reference configuration same (from RAN1 perspective) as in eIMTA (but not associated with eIMTA)
- Working assumption: RRC configure whether SRS flexible timing applies. No timing ambiguity between eNB and UE for SRS transmission is allowed. Details FFS.

Not treated.

R1-1609985	Collision Handling	Qualcomm Incorporated
R1-1608589	Details on collision handling for SRS switching	Huawei, HiSilicon
R1-1609031	SRS Collisions due to Carrier Switching	Samsung
R1-1609474	Collision handling for SRS CC-based switching	Intel Corporation
R1-1609686	General principles for handling interruptions with SRS carrier based switching	Ericsson
R1-1609687	PUCCH in SRS carrier switching	Ericsson
R1-1609688	PUSCH in SRS carrier switching	Ericsson
R1-1609689	SRS switching within the Special subframe	Ericsson

7.2.5.4 Other

Including details for SRS from each of the multiple antennas with carrier switching

R1-1609032	SRS Switching for UE with Multiple Antennas	Samsung
R1-1609986	Support of multiple antennas for SRS switching	Qualcomm Incorporated
R1-1608590	Details on SRS switching for UEs with multiple antennas	Huawei, HiSilicon
R1-1608739	On SRS carrier switching with antenna switching	CATT

7.2.6 Further Indoor Positioning enhancements for UTRA and LTE - *WID in RP-161850*

R1-1610869 Chairman's notes of AI 7.2.6 on Further Indoor Positioning enhancements for UTRA and LTE Ad-Hoc chair (Qualcomm)

The document was presented by Wanshi Chen from Qualcomm.

Decision: The document is endorsed and content incorporated below.

7.2.6.1 Remaining issues for OTDOA enhancements

R1-1609475	CRS Usage together with PRS	Intel Corporation
R1-1609987	Introduction of UE inter-frequency RSTD calibration accuracy reporting	Qualcomm Incorporated
R1-1610215	RSTD Reporting Enhancement in OTDOA	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610383	Multipath RSTD reporting per cell for enhanced indoor positioning	Ericsson, Nokia

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R1-1610384 On combining of CRS and PRS for enhanced indoor positioning Ericsson

R1-1610909 WF on Multipath RSTD Ericsson, Nokia, Qualcomm, Acorn Technology

Agreements:

- RAN1 decides to prioritize the following for the OTDOA enhancement
  - Support Multipath RSTD reporting by UE to E-SMLC
  - Multipath RSTD includes relative timing difference information of up to two additional peaks (i.e., 0, 1 or 2) relative the reference peak for each cell (reference or neighbor).
  - The reference peak of a cell (reference and neighbor) is the peak used for the current RSTD reporting determined by the UE to be the most likely.
  - Based on a maximum relative timing difference of 4μs and a resolution of 0.5Ts, each relative timing difference is represented by an integer in the range [-256…255].
  - TOA reporting and optional uncertainty reporting from UE should be explicitly defined in the LS
  - Note: there will not be new measurement definition intended for 36.214
  - Send LS to RAN2 and cc RAN3 RAN4.

R1-1610527 Way forward on CRS usage together with PRS Intel Corporation, Acorn Technologies, Huawei, HiSilicon, Sony

Agreements:

- Support the use of CRS together with PRS for OTDOA enhancement
  - If CRS usage together with PRS is configured,
    - Signal CP information for CRS if PRS is present.
      - Note: this CP information signaling is additional one to the existing CP signaling for PRS.
    - Quasi-collocation between PRS and CRS is assumed.
    - FFS signaling of CRS presence (e.g., due to MBSFN subframes)
- Send the LS for the above to RAN2 and cc RAN3 RAN4 to be captured for their works.

Friday
R1-1610972 [DRAFT] LS on Multipath RSTD reporting and CRS usage together with PRS Ericsson, Intel
Discussion: Comment that "RAN1 confirms that there is no RAN4 impacts" → no change needed, this is a RAN4 issue.
Decision: The document is noted and final LS is agreed in R1-1611052

7.2.6.2 PRS-based beacons

R1-1609988 Draft CR 36.211: Additional PRS configuration indices for PRS-based Terrestrial Beacon SystemsQualcomm Incorporated
R1-1609989 Draft CR 36.213: Introduction of PRS-only transmission points for PRS-based Terrestrial Beacon Systems Qualcomm Incorporated
R1-1609990 PRS CP length in MBSFN subframes Qualcomm Incorporated
R1-1610427 Discussion of PRS-Based Beacon for Indoor Positioning Nokia, Alcatel-Lucent Shanghai Bell
R1-1610385 PRS patterns for PRS-based TBS for enhanced indoor positioning Ericsson

R1-1610928 WF on PRS-Based RSRP/RSRQ Measurement and Reporting for PRS-Based Beacon Nokia, Alcatel-Lucent Shanghai Bell
Proposals:

- Support PRS-based RSRP/RSRQ measurement and reporting
  - Interface/protocol
    - FFS Alt. 1: PRS-based RSRP/RSRQ measurement configuration and reporting by RRC signalling
    - Alt. 2: PRS-based RSRP/RSRQ measurement configuration and reporting by LPP
  - Number of PRS-based beacons for RSRP/RSRQ measurement and reporting
    - Up to 9 PRS-based beacons per UE for RSRP/RSRQ
  - Value range
    - The value range of PRS-based RSRP: INTEGER (0…97) [Same as RSRP value range in LPP]
    - The value range of PRS-based RSRQ: INTEGER (0…34) [Same as RSRQ value range in LPP]
  - Reporting Mode
    - Alt. 1: Periodic: 120ms, 240ms, 480ms, 640ms, 1024ms, 2048ms, 5120ms, 10240ms, 1min, 6min, 12min, 30min, 60min [Same as E-CID measurement periodicity in LPP]
    - Alt. 2: Aperiodic
    - Alt. 3: Event triggered, for example PRS resource becomes better than absolute threshold

Further discussion until next meeting, especially in relation to an alternative proposal to use CSI-RS for RSRP/RSRQ measurement and reporting in E-CID enhancements

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7.2.6.3 E-CID enhancements

R1-1609351 Further discussion on the same PCI case for E-CID enhancements Huawei, HiSilicon
R1-1609352 Further discussion on the UE Rx-Tx measurement over multiple serving cells Huawei, HiSilicon
R1-1610386 On CSI-RSRP reporting support to E-SMLC for enhanced indoor positioning Ericsson

7.2.6.4 Other

R1-1610387 Defining indoor/outdoor classification for enhanced indoor positioning Ericsson

7.2.7 Uplink Capacity Enhancements for LTE - *WID in RP-160664*

Specification of PUSCH in special subframe, with focus on the design of HARQ timing, TBS determination, UL DM-RS, TTI bundling, related signalling and procedure

R1-1610870 Chairman's notes of AI 7.2.7 on Uplink Capacity Enhancements for LTE Ad-Hoc chair (Ericsson)
The document was presented on behalf of Sorour Falahati from Ericsson.
Decision: The document is endorsed and content incorporated below.

R1-1608607 Further Discussion on Scheduling and HARQ Timing for PUSCH on UpPTS Huawei, HiSilicon
R1-1609297 Discussion on HARQ timing design for PUSCH in UpPTS CMCC
R1-1609883 HARQ timing for PUSCH transmission in special subframe Nokia, Alcatel-Lucent Shanghai Bell

R1-1610695 WF on HARQ timing for PUSCH in UpPTS CMCC
R1-1610696 WF on DMRS for PUSCH in UpPTS CMCC

Agreement:

- For TDD UL/DL configuration 1~5
  - Support adaptive HARQ transmission, and specify the timing from PUSCH to PUSCH retransmission grant according to the following table

TDD DL/UL config.	UL subframe index n									
	0	1	2	3	4	5	6	7	8	9
1		4	4	6			4	4	6	
2		5	6				5	6		
3		6	6	6	6					
4		6	6	6						
5		6	6							

  - Support non-adaptive HARQ transmission

FFS the timing from PUSCH to its ACK/NACK feedback in PHICH

Agreement:

- For TDD UL/DL configuration 6, support the following timing design from UL grant to PUSCH
  - Introduce two bits for UL index field in DCI for UL grant in UE specific search space
  - The UL index is interpreted as
    - When MSB=1 and LSB=0: UE shall upon detection of a PDCCH with DCI format 0/4 in subframe n intended for the UE, adjust the corresponding PUSCH transmission in subframe n+k, with the value of k in the following table
    - When MSB=0 and LSB=1: UE shall adjust the corresponding PUSCH transmission in subframe n+6
    - When MSB=1 and LSB=1: UE shall adjust the corresponding PUSCH transmission in both subframes n+k and n+6, with the value of k in the following table

TDD UL/DL Config	DL subframe index n									
	0	1	2	3	4	5	6	7	8	9
6	7	7				7	7			5

Agreement:

- For TDD UL/DL configuration 0 and 6
  - Support both adaptive and non-adaptive HARQ transmission, and specify the timing from PUSCH to its ACK/NACK feedback in PHICH or UL grant for retransmission according to the following table

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TDD UL/DL Config	subframe index n									
	0	1	2	3	4	5	6	7	8	9
0		5	4	7	6		5	4	7	6
6		4	4	6	6		4	4	7	

Agreement:

- DMRS for PUSCH in UpPTS is transmitted in the UpPTS
  - Working assumption: DMRS is transmitted in the symbol index *l*=3 for normal CP, and the symbol index *l*=2 for extended CP
  - FFS: Support additionally the following alternative by RRC configuration for DMRS transmission for PUSCH in UpPTS:
    - DMRS for PUSCH in UpPTS is transmitted in the following UL subframe, and reuse the legacy DMRS pattern in normal UL subframe

Working assumption:

- For TDD UL/DL configuration 0
  - Support the following for timing from UL grant to PUSCH
    - Change the interpretation of UL index field
      - MSB=1, LSB=0: UE shall upon detection of a PDCCH with DCI format 0 in subframe n intended for the UE, adjust the corresponding PUSCH transmission in subframe n+k, with k given in the following table.
      - MSB=0, LSB=1: UE shall adjust the corresponding PUSCH transmission in subframe n+7
      - MSB=1, LSB=1: UE shall adjust the corresponding PUSCH transmission in both subframes n+ k and n+7, with k in the following table

TDD UL/DL Config	DL subframe index n									
	0	1	2	3	4	5	6	7	8	9
0	4	5				4	5			

Not treated.

R1-1608608 Transmission of PUSCH on UpPTSHuawei, HiSilicon
R1-1608740 Remaining issues for PUSCH support in UpPTS CATT
R1-1609294 Discussion on DMRS design for PUSCH in UpPTS CMCC
R1-1609295 Discussion on TBS scaling design for PUSCH in UpPTS CMCC
R1-1609296 Discussion on TTI bundling for PUSCH in UpPTS CMCC
R1-1609354 Discussion on UCI in PUSCH on UpPTS Huawei, HiSilicon
R1-1609884 HARQ timing for TTI bundling for PUSCH transmission in special subframe Nokia, Alcatel-Lucent Shanghai Bell
R1-1609991 PUSCH in UpPTS Qualcomm Incorporated
R1-1610697 Way Forward on timing design for TTI bundling CMCC
R1-1610698 Way Forward on TBS scalling design for PUSCH UpPTS CMCC

7.2.8 Further Enhanced MTC for LTE - *WID in RP-161464*

R1-1610871 Chairman's notes of AI 7.2.8 on Further Enhanced MTC for LTE Ad-Hoc chair (Nokia, Ericsson)

The document was presented by Johan Bergman from Ericsson.

Decision: The document is endorsed and content incorporated below.

7.2.8.1 Higher data rates

Contributions relevant for more than one sub-topic (e.g. joint DCI design) are submitted to this agenda item

R1-1608623 Considerations on the control channel of supporting wider bandwidth in FeMTC Huawei, HiSilicon
R1-1608624 DCI design on supporting wider bandwidth in FeMTC Huawei, HiSilicon
R1-1609204 Fallback operation for FeMTC LG Electronics
R1-1609397 Discussion on Higher Data Rate for Further eMTC Lenovo
R1-1609476 Overall DCI design options for higher data rates for FeMTC Intel Corporation

R1-1610661 WF on DCI for higher data rates in FeMTC Ericsson, Qualcomm, Sony, NTT DoCoMo, Intel, Kyocera, KT Corp., Sierra Wireless

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Agreement:
- FeMTC UEs use Rel-13 DCI formats for MPDCCH Type-0/1/2 CSS transmissions.

Proposal:
- FeMTC UEs use Rel-13 or Rel-14 DCI formats for MPDCCH USS transmissions.
  - It is FFS whether the Rel-14 DCI formats are backwards compatible with the same size as the Rel-13 DCI formats or whether they can have a different size.

R1-1610630 WF on RRC reconfiguration for FeMTC features Qualcomm, Ericsson, Sony, Sequans, DOCOMO, Virtuosys, Sierra Wireless, Kyocera
Also supported by Intel and ZTE and Nokia.

Agreement:
- The following FeMTC features:
  1. HARQ-ACK bundling
  2. Larger maximum TBS for 1.4MHz operation
  3. Larger maximum TBS for 5MHz operation
  4. Support of larger bandwidth
  5. 10 HARQ processes for downlink

  are enabled as follows:
  - The UE reports capability to support a given feature
  - FFS: The eNB enables the larger bandwidth and larger TBS by RRC reconfiguration
  - The eNB enables the other features by RRC reconfiguration
- FFS: dependency between different features
  - E.g. a UE that supports 5MHz operation shall support larger maximum TBS.

R1-1609156 Retuning Symbols for FeMTC in Rel-14 NEC
R1-1610662 WF on retuning symbols in FeMTC Ericsson, NEC, Sequans, Sierra Wireless

Agreement:
- Rel-14 UE supporting CE mode A and/or B can indicate how many narrowband retuning symbols it needs.
  - Range: {0, 1, 2} symbols
  - Default value: 2 symbols
- FFS: If the UE indicates it needs 1 symbol for retuning, then:
  - When retuning between two PUSCH narrowbands, the guard period is the last SC-FDMA symbol in the previous UL subframe
  - When retuning between two PUCCH narrowbands, the guard period is the last SC-FDMA symbol in the previous UL subframe
  - When retuning from a PUSCH narrowband to a PUCCH narrowband, the guard period is the last SC-FDMA symbol in the previous UL subframe
  - When retuning from a PUCCH narrowband to a PUSCH narrowband, the guard period is the first SC-FDMA symbol in the next UL subframe
- It is up to eNB whether and how to take the UE capability into account.

7.2.8.1.1 Larger max PDSCH/PUSCH TBS

R1-1608626 On supporting larger TBS for UEs with maximum 1.4 MHz bandwidth in TDD/HD-FDD Huawei, HiSilicon
R1-1608627 On supporting larger TBS for UEs with larger bandwidth Huawei, HiSilicon
R1-1608890 Maximum TBS for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1609477 Support of larger max TBS for DL and UL Intel Corporation
R1-1609992 Support of higher data rates Qualcomm Incorporated
R1-1610388 Larger max TBS for MTC Ericsson
R1-1610407 Design for larger maximum TBS Kyocera Corporation

R1-1610663 WF on TBS for FeMTC Ericsson, Qualcomm, Sony

Agreement:
- Supported modulation schemes for Rel-14 BL/CE UEs:
  - PDSCH: QPSK, 16QAM
  - PUSCH: QPSK, 16QAM

Agreement:
- Max TBS for 5-MHz Rel-14 BL/CE UEs:
  - PDSCH: 4008 bits

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- PUSCH: 4008 bits

Agreement:
- Soft buffer size for 5-MHz Rel-14 BL UEs:
  - Option 1: N·96·⌈(X+28)/32⌉ where N = max number of DL HARQ processes and X = max DL TBS
  - Option 2: a smaller value than in Option 1
- Option 2 is agreed
  - Details are FFS

Agreement:
- Max UL TBS in CE mode A for 1.4-MHz Rel-14 BL FD-FDD UE:
  - Option A: 1000 bits (same as Rel-13 Cat-M1)
  - Option B: 2984 bits (same as 1.4-MHz FeMTC TDD/HD-FDD UE)
- Option B is agreed

R1-1610817 WF on TBS indication for 1.4 MHz feMTC UEs Huawei, HiSilicon, Qualcomm

Agreement:
- TBS for 1.4-MHz UE in CE mode A is indicated by using the existing TBS table
  - Introduce UE capability signaling for the larger TBS
  - The use of larger TBS is RRC configured by eNB

R1-1610861 WF on TBS indication for 1.4 MHz feMTC UEs Huawei, HiSilicon, Nokia, Qualcomm, Sierra Wireless

Agreement: The tables in R1-1610861 are agreed.

7.2.8.1.2 Larger max PDSCH/PUSCH channel bandwidth

R1-1608622	On enabling and disabling of wider bandwidth in FeMTC	Huawei, HiSilicon
R1-1608625	On supporting larger channel bandwidth for Rel-14 non-BL UEs in CE mode A	Huawei, HiSilicon
R1-1608891	Consideration on supporting larger channel bandwidth for FeMTC	Nokia, Alcatel-Lucent Shanghai Bell
R1-1608937	Resource Allocation in wide bandwidth feMTC	Sony
R1-1609154	Larger maximum PDSCH/PUSCH channel bandwidth in CE mode A	NEC
R1-1609205	Larger channel bandwidth for FeMTC	LG Electronics
R1-1609478	Support of larger max channel bandwidth for PDSCH/PUSCH	Intel Corporation
R1-1609828	Discussion on support of larger PDSCH/PUSCH bandwidth for MTC	ZTE
R1-1609829	Resource allocation for larger PDSCH/PUSCH bandwidth for MTC	ZTE
R1-1609993	Support of larger data channel bandwidth	Qualcomm Incorporated
R1-1610389	Larger max channel bandwidth for MTC	Ericsson
R1-1610406	Design for larger max PDSCH/PUSCH channel bandwidth	Kyocera Corporation

R1-1610650 WF on support of larger PDSCH/PUSCH channel bandwidth for MTC ZTE, ZTE Microelectronics

Agreement:
- Rel-14 non-BL UE can support CE mode A in connected mode with a maximum PDSCH/PUSCH channel bandwidth of either 5 or 20 MHz.
  - Rel-14 capability signaling is introduced to differentiate non-BL UEs with respect to maximum UE channel BW support in CE.
- Rel-14 non-BL UE may also support Rel-13 CE mode A and CE mode B.
- A Rel-14 non-BL UE supporting CE mode A operation with 20-MHz maximum PDSCH/PUSCH channel bandwidth also supports CE mode A operation with 5-MHz maximum channel bandwidth.
- Strive for commonality in the DCI design for the 5-MHz and 20-MHz cases without introducing unnecessary overhead for the 5-MHz case.
- FFS whether to support frequency hopping for PDSCH/PUSCH channel bandwidths >5 MHz

R1-1610684 WF on supporting larger channel bandwidth for Rel-14 non-BL UEs Huawei, HiSilicon, Qualcomm

Agreement:
- The larger maximum UE channel BW for PDSCH is supported for both CE mode A and CE mode B.
- The larger maximum UE channel BW for PUSCH is not supported for CE mode B.
- For the 5-MHz BL UE,
  - The maximum reception bandwidth is 25 PRBs.
  - The maximum allocatable PDSCH channel bandwidth is [FFS between 24 or 25] PRBs.
  - The maximum transmission bandwidth is 25 PRBs.

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- The maximum allocatable PUSCH channel bandwidth is [FFS between 24 or 25] PRBs.

7.2.8.1.3 HARQ-ACK bundling in HD-FDD

R1-1608630 HARQ-ACK bundling in HD-FDD Huawei, HiSilicon
R1-1608797 Design of HARQ-ACK bundling for HD-FDD Sequans Communications
R1-1608892 ACK/NACK Bundling in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1608938 Considerations on HARQ-ACK Bundling in HD-FDD Sony
R1-1609155 Different Options for HARQ-ACK bundling in CE mode A for HD-FDD NEC
R1-1609819 Ack Bundling Design Considerations Sierra Wireless, S.A.
R1-1609830 Support of HARQ-ACK bundling for MTC ZTE
R1-1609994 Support of HARQ-ACK bundling in HD-FDD Qualcomm Incorporated
R1-1610025 HARQ bundling design for HD-FDD in Rel-14 MTC NTT DOCOMO, INC.
R1-1610390 HARQ-ACK bundling for MTC Ericsson

R1-1610651 WF on HARQ bundling in HD-FDD for MTC ZTE, ZTE Microelectronics, Sony, Lenovo, NTT Docomo, Sierra Wireless, Sequans

Also supported by Qualcomm

Agreement:

- HARQ-ACK bundling is supported in CE Mode A in HD-FDD.
- HARQ-ACK bundling is not supported in CE Mode B.
- FFS whether HARQ-ACK bundling is supported in CE Mode A in FD-FDD.
- FFS whether HARQ-ACK bundling is supported for PUCCH repetition case.
- FFS whether HARQ-ACK bundling is supported for PDSCH repetition case.
- FFS whether HARQ-ACK bundling is supported for MPDCCH repetition case.

R1-1610824 WF on bundle size and bundle number in HD-FDD for MTC ZTE, ZTE Microelectronics, Sierra Wireless, Ericsson, Lenovo, Sony

Agreement:

- One or multiple HARQ-ACK bundles can be supported for PDSCH scheduling before switching to UL.
  - HARQ-ACK bundle size is defined as the number of PDSCH transmissions (corresponding to different HARQ processes) with a joint HARQ-ACK feedback.
  - The maximum HARQ-ACK bundle size is 4.
  - FFS: maximum number of HARQ-ACK bundles before switching to UL

7.2.8.1.4 Number of DL processes in FD-FDD

R1-1608629 Analysis on increasing DL HARQ processes in CE mode A for FD-FDD Huawei, HiSilicon
R1-1608798 On supporting 10 DL HARQ processes Sequans Communications
R1-1608893 Increasing the number of HARQ processes in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1608939 Considerations on HARQ Processes in FD-FDD Sony
R1-1609831 Discussion on Number of DL processes in FD-FDD for MTC ZTE
R1-1610026 Indication of up to 10 HARQ process number for FD-FDD in Rel-14 MTC NTT DOCOMO, INC.
R1-1610391 Number of DL HARQ processes for MTC Ericsson

R1-1610670 WF on supporting 10 HARQ processes Sequans, Intel, Sony, Ericsson

Also supported by Sierra Wireless and Qualcomm

Agreement:

- For HD-FDD and FD-FDD,
  - Support for max 10 DL HARQ processes in CE mode A is introduced for Rel-14 BL UEs
  - A 1.4-MHz BL UE supporting max 10 DL HARQ processes has the same required soft buffer size as Rel-13 Cat-M1 UE

7.2.8.2 Multicast support

R1-1608628 Consideration on SC-PTM transmission for FeMTC Huawei, HiSilicon
R1-1608894 SPS Design Considerations Nokia, Alcatel-Lucent Shanghai Bell
R1-1608895 SC-PTM Search Space Considerations Nokia, Alcatel-Lucent Shanghai Bell
R1-1608940 Multicast Support for feMTC Sony
R1-1609206 Multicast support for FeMTC LG Electronics
R1-1609358 Control channel design on supporting SC-PTM in FeMTC Huawei, HiSilicon
R1-1609479 SC-PTM for FeMTC Intel Corporation
R1-1609606 on supporting multicast with large TBS Sequans Communications
R1-1609832 Discussion on multicast support for MTC ZTE
R1-1609867 Further discussion on the change notification of SC-PTM for FeMTC Sharp

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R1-1609995 Support of multicast Qualcomm Incorporated
R1-1610392 Collision handling for multicast support for MTC Ericsson
R1-1610393 L1 configuration for multicast support for MTC Ericsson

R1-1610820 WF on FeMTC SC-PTM scheduling Ericsson, ITL, Nokia, ASB

Agreement:

- Max channel bandwidth and max TBS for **SC-MTCH** PDSCH transmission to BL/CE UEs:
  - **Option 1:** According to Rel-13 Cat-M1 limitations (i.e. 6 PRBs and 1000 bits)
  - **Option 2:** Configurable per SC-MTCH (with minimum maximum values of 6 PRBs and 1000 bits)
- Max channel bandwidth and max TBS for **SC-MCCH** PDSCH transmission to BL/CE UEs:
  - **Option A:** According to Rel-13 Cat-M1 limitations (i.e. 6 PRBs and 1000 bits)
  - **Option B:** Configurable per SC-MCCH (with minimum maximum values of 6 PRBs and 1000 bits)
- From physical layer point of view,
  - All four options are feasible.
  - Option 2 may have performance benefits over Option 1.
- Ask RAN2 to confirm feasibility and usefulness from higher layer point of view.

Agreement:

- The maximum number of on-going SC-MTCHs supported by SC-MCCH is reduced compared to LTE.
- Send LS to RAN2 to
  - Inform RAN2 that RAN1 assumes the maximum number of on-going SC-MTCHs supported by SC-MCCH is reduced compared to LTE
  - Request RAN2 to inform RAN1 of the maximum number of on-going SC-MTCHs supported by SC-MCCH in FeMTC.
  - Request RAN2 to inform RAN1 whether and how segmentation of SC-MCCH will be supported in Rel-14.
- For the search space scheduling SC-MCCH
  - UE monitoring of blind decoding candidates is based on FFS: Type1-CSS or Type2-CSS for MPDCCH
  - Rmax, and G values are configured per SC-MCCH by higher layers
    - FFS the configuration of other parameters, e.g., narrowband.

Cover FeMTC and NB-IoT in the same LS to RAN2 (Huawei)

R1-1610666 WF on FeMTC SC-MTCH transmission Ericsson, Nokia, ASB

Agreement:

- Frequency hopping is supported in multicast to BL/CE UEs at least for max PDSCH channel bandwidth of 6 PRBs.
  - FFS whether the frequency hopping is controlled by the same SIB parameters as other DL transmissions or by separate SIB parameters and/or DCI

Proposal:

- The possibility of combining of multicast transmissions of the same UDP/IP packet can be studied till the next meeting.

R1-1610664 Way Forward on FeMTC SC-PTM scheduling Ericsson
R1-1610665 Way Forward on FeMTC multicast collision handling Ericsson
R1-1610706 Way Forward on DCI format for SC-PTM Huawei, HiSilicon
R1-1610707 Way Forward on SC-PTM configuration and scheduling Huawei, HiSilicon

7.2.8.3 OTDOA enhancements

Consider improvements of accuracy, UE complexity and power consumption

R1-1608896 OTDOA enhancements for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1608950 OTDoA enhancements for feMTC Sony
R1-1609359 Discussion on the OTDOA enhancements for FeMTC Huawei, HiSilicon
R1-1609370 Evaluations of feMTC OTDOA Huawei, HiSilicon
R1-1609839 Discussion on OTDOA support for eMTC ZTE
R1-1609996 OTDOA enhancements Qualcomm Incorporated
R1-1610394 OTDOA enhancements for MTC Ericsson

R1-1610934 WF on OTDOA for feMTC ZTE , ZTE Microelectronics, Ericsson, Qualcomm

Agreement:

- For Rel-14 feMTC OTDOA positioning reference signal, enhancements to the legacy LTE PRS patterns and sequences can be considered but need to be justified by significant performance improvement compared to legacy
  - Strive for the possibility for the legacy PRS REs to overlap with the Rel-14 PRS REs
- Rel-14 PRS configuration includes

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- All legacy parameters, i.e., bandwidth, periodicity, subframe offset, number of consecutive subframes, etc.
- FFS transmission in invalid subframes
- Sets of values of the parameters are FFS
- Determination of frequency location remains FFS
- Details of Rel-14 PRS configuration parameter settings are FFS
- Details of Rel-14 PRS muting pattern are FFS
- FFS how many Rel-14 PRS configurations are needed per cell
- FFS how many Rel-14 PRS configurations are needed per UE

- RSTD measurement of PRS in different sets of PRBs in the frequency domain is supported
  - FFS details

R1-1610621 WF on PRS Frequency Hopping for OTDOA Sony, ZTE, Ericsson, Virtuosys

Agreement:

- Frequency hopping of PRS in OTDOA is supported.
  - Configurations and details are FFS

7.2.8.4 VoLTE enhancements

Increase VoLTE coverage for half-duplex FDD/TDD through techniques to reduce DL repetitions, new repetition factors, and adjusted scheduling delays

R1-1608655 SRS enhancement to supporting higher data rates Huawei, HiSilicon
R1-1608897 VoLTE performance for Cat-M1 UE Nokia, Alcatel-Lucent Shanghai Bell
R1-1608898 VoLTE enhancements for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1609369 On half duplex enhancements for VoLTE Huawei, HiSilicon
R1-1609480 VoLTE enhancements for HD-FDD and TDD UEs Intel Corporation
R1-1609997 VoLTE enhancements for eMTC Qualcomm Incorporated
R1-1610395 VoLTE enhancements for CE mode A Ericsson

R1-1610922 WF on FeMTC eVoLTE Huawei, HiSilicon, Ericsson, Qualcomm, Sequans

Agreement:

- RAN1 design will assume delay budget relaxation for UL voice packets
- Prioritize consideration of the following in VoLTE enhancements in FeMTC for BL/CE UE considering overall system impacts:
  - New number(s) of repetitions for PUSCH
  - Adjusted scheduling relationships between physical channels
  - SRS coverage enhancement
  - Discontinuous PUSCH transmission
- SPS and non-SPS cases should both be considered
- Ask RAN2+RAN4: What can be assumed regarding need for intra- and inter-frequency measurement gaps, in synchronized and non-synchronized networks
- Ask RAN2: For feedback on what delay budget relaxation can be assumed

Provide LS to RAN2 and RAN4 (Matthew, Huawei)

Friday

R1-1611017 [DRAFT]LS on FeMTC VoLTE enhancements Huawei

Decision: The document is noted and final LS agreed in R1-1611053

7.2.8.5 Other

R1-1609998 Paging channel enhancements Qualcomm Incorporated
R1-1609999 Power consumption reduction techniques for eMTC Qualcomm Incorporated

7.2.9 Enhancements of NB-IoT - *WID in RP-161901.*

The objectives apply to the in-band, guard-band, and standalone operation modes and the same coverage enhancement targets as defined in the Rel-13 NB-IoT work item.

R1-1610872 Chairman's notes of AI 7.2.9 on Enhancements of NB-IoT Ad-Hoc chair (Huawei)

The document was presented by Matthew Webb from Huawei.

Discussion: Straightforward approval of already endorsed LSs – just add final Tdoc numbers of R1-1611032/R1-1611033/R1-1611034)

Decision: The document is endorsed and content incorporated below.

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7.2.9.1 Positioning

7.2.9.1.1 Design of narrowband OTDOA positioning

Re-use of existing signals

R1-1608617 On reusing existing downlink signals for NB-IoT downlink positioning Huawei, HiSilicon
R1-1608881 Existing Downlink Signals for OTDOA Positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608698 OTDOA performance for NB-IoT Ericsson

Agreement:

- Introduce a new positioning reference signal for OTDOA in NB-IoT
  - Not based on existing Rel-13 NB-IoT signal and not based on LTE CRS.

R1-1610346 On the use of exising NB-IoT signals for OTDOA Ericsson

New designs for NPRS

R1-1608618 Design of new downlink positioning reference signal for NB-IoT Huawei, HiSilicon
R1-1610000 Downlink-based narrowband positioning Qualcomm Incorporated

Configurations

R1-1608619 Configuration of downlink positioning reference signal for NB-IoT Huawei, HiSilicon

R1-1608882 NPRS Design for OTDOA Positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608697 OTDOA design for NB-IoT Ericsson
R1-1609207 OTDOA design for eNB-IoT LG Electronics

Working assumptions:

- NB-IoT positioning reference signal resource pattern in one subframe is at least LTE PRS in 1 PRB
  - FFS: With additional REs in guard-band and standalone operation modes
  - FFS: Increased density per cell according to coverage
  - NB-IoT PRS do not occur in a subframe containing
    - NPDCCH
    - NPDSCH
    - NPBCH
    - NPSS/NSSS

R1-1609835 OTDOA positioning for NB-IoT ZTE
R1-1610221 Support of OTDOA in NB-IoT Innovative Technology Lab Co.
R1-1609377 RSTD measurement and reporting in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1610434 A new system simulator for NB-IoT positioning Ericsson (R1-1608699)

R1-1610639 WF on configurations of time resources for NPRS Huawei, HiSilicon

Agreement:

- The subframes which contain NPRS are configured by higher-layers
  - Per NB-IoT carrier, it is possible to configure the subframes used NPRS transmission such that NPRS do not occur in subframes containing transmissions to Rel-13 UEs in the cell of:
    - NPDCCH
    - NPDSCH
    - NPBCH
    - NPSS/NSSS

Agreement:

- Configuration of time resources for NPRS
  - Indication of exact subframes is by
    - Alt. 4:
      - Part A: A bitmap on subframes which are not NB-IoT DL subframes (i.e. invalid DL subframes)
        - Alt. 4.A1: Bitmap is a fixed length of 10 bits
        - Alt. 4.A2: Bitmap is a the same length as valid subframe configuration, i.e. 10 bits or 40 bits
        - Alt. 4.A3: Bitmap is a fixed length of x bits (e.g., $x = 20$)
        - FFS which until RAN1#87

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- Part B: Indicated with one start subframe, one periodicity, and one number of repetitions for the occasions
- On an anchor carrier, Part A and/or Part B
- On a non-anchor carrier, Part A and/or Part B

Agreement:

- Indication of NPRS muting patterns is
  - Alt. 2: Indicated with a periodic NPRS muting sequence
    - Details are FFS

R1-1610640 WF on configuration of NPRS transmission on multiple NB-IoT carriers Huawei, HiSilicon
R1-1610641 WF on configuration of NPRS power for NB-IoT downlink positioning Huawei, HiSilicon

- Send LS to RAN4
  - Referencing the 36.104 section on PSD boosting
  - Include the working assumption on NPRS resource pattern
  - Asking if PSD boosting of REs used in NPRS relative to NRS can be supported, for in-band, guard-band and standalone operation, and for anchor and non-anchor carriers where NRS are transmitted.
    - Note that it is FFS in RAN1 if NRS is present on a non-anchor carrier on which NPRS are transmitted
  - Asking if PSD boosting of REs used in NPRS relative to anchor carrier NRS can be supported, for in-band, guard-band and standalone operation, and for non-anchor carriers where NRS are not transmitted.
  - Asking what is an appropriate limit and granularity of PSD boosting in the above cases.

R1-1611006 [DRAFT]LS on on configuration of NPRS power for NB-IoT downlink positioning
The LS is endorsed, with "respectively" replaced by "respectfully". Final LS is agreed in R1-1611032

7.2.9.1.2 Evaluation of narrowband OTDOA positioning

R1-1608620 Evaluation of downlink positioning accuracy for NB-IoT Huawei, HiSilicon
R1-1608621 Analysis of power consumption and complexity for NB-IoT downlink positioning Huawei, HiSilicon

7.2.9.1.3 Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission

R1-1608647 On reusing existing uplink signals for NB-IoT uplink positioning Huawei, HiSilicon
R1-1609836 UTDOA positioning for NB-IoT ZTE
R1-1608880 UTDOA positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608700 On modelling of NPRACH based UTDOA performance Ericsson
R1-1608701 On NPRACH based UTDOA impact on NB-IOT performance Ericsson
R1-1608702 On NPRACH based UTDOA capacity Ericsson
R1-1610001 Uplink-based narrowband positioning Qualcomm Incorporated

R1-1610905 WF on positioning reference signal design for NB-IoT UTDOA ZTE , ZTE Microelectronics

Conclusions:

- Rel-13 NPRACH preamble is the best candidate and can be used as a signal for NB-IoT UTDOA in some scenarios.
  - Whether it is feasible in a given network deployment depends on issues including network coordination, interference handling, power control, in-band emissions, capacity impacts, etc.
  - Companies are encouraged to identify in RAN1#87 scenarios where it is and is not feasible.

7.2.9.2 Multicast support

Extend Rel-13 SC-PTM to support multicast downlink transmission

SC-MCCH
R1-1608884 SC-MCCH transmission for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608612 Discussion on configuration of SC-MTCH in NB-IoT Huawei, HiSilicon
R1-1608703 L1 configuration for multicast support for NB-IoTEricsson
R1-1610002 Support of multicast Qualcomm Incorporated

R1-1610643 WF on SC-MCCH transmission for NB-IoT SC-PTM Huawei, HiSilicon
Also supported by ITL

Agreements:

- The maximum number of on-going SC-MTCHs supported by SC-MCCH is reduced compared to LTE.
- Send LS to RAN2 to

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- Inform RAN2 that RAN1 assumes the maximum number of on-going SC-MTCHs supported by SC-MCCH is reduced compared to LTE
- Request RAN2 to inform RAN1 of the maximum number of on-going SC-MTCHs supported by SC-MCCH in NB-IoT.
- Also include the larger maximum TBS value (if agreed this week)
- Request RAN2 to inform RAN1 whether and how segmentation of SC-MCCH will be supported in Rel-14.

R1-1610969 **[DRAFT]LS on SC-MCCH transmission in NB-IoT**
The LS is endorsed, with the following update:
- ~~[~~The larger maximum TBS value in downlink in Rel-14 is 1352 bits~~[x]~~ for NB-IoT, and 4008 bits~~[y]~~ for feMTC.~~]~~

Final LS is agreed in R1-1611033

R1-1610551 **WF on NB IoT SC-PTM scheduling** **Ericsson**

Agreements:
- Transmission of a given SC-MCCH is restricted to one NB-IoT carrier
- Transmission of a given SC-MTCH is restricted to one NB-IoT carrier

SC-MTCH
R1-1610552 **Draft_WF on NB IoT SC-MTCH transmission Ericsson**
R1-1610642 **WF on SC-MTCH transmission for NB-IoT SC-PTM** **Huawei, HiSilicon**

Agreement:
- Different SC-MTCHs can be transmitted over different NB-IoT carriers, while one SC-MTCH is sent on one NB-IoT carrier

Search spaces and DCIs
R1-1610644 **WF on search space design for SC-PTM in NB-IoT** **Huawei, HiSilicon**

Agreements:
- For the search space scheduling SC-MCCH (called Type1-MSS for RAN1 purposes)
  - UE monitoring of blind decoding candidates is based on FFS: Type1-CSS or Type2-CSS
  - α, Rmax, and G values for Type1-MSS are configured per SC-MCCH by higher layers

R1-1610968 **WF on search space for NB-IoT SC-PTM** **Huawei, HiSilicon, ZTE**

Agreements:
- For the search space scheduling SC-MTCH (called Type2-MSS for RAN1 purposes)
  - UE monitoring of blind decoding candidates is based on FFS: Type1-CSS or Type2-CSS
  - α, Rmax, and G values for Type2-MSS are configured per SC-MTCH in SC-MCCH
- UE is not required to simultaneously monitor Type1-MSS and Type2-MSS
- UE is not required to monitor Type2-MSS while receiving NPDSCH carrying SC-MTCH

Collision handling
R1-1610468 WF on collision issue on SC-PTM for eNB-IoT LG Electronics, ITL
R1-1610553 WF on NB IoT multicast collision handling Ericsson

Agreement
- Prepare a LS to RAN2, RAN3, SA2
  - There may be cases where the UE cannot monitor NPDCCH search spaces and/or receive NPDSCH transmissions for both paging and SC-PTM simultaneously

R1-1610970 **[DRAFT]**LS on collisions between SC-PTM and Paging in NB-IoT
The LS is endorsed with the following update:
RAN1 respectfully ask RAN2, RAN3 and SA2 to take the above into consideration in their work.~~ that the reliability of SC-PTM would be impacted if SC-PTM transmissions are dropped when collision happens between SC-PTM and paging.~~
Final LS is agreed in R1-1611034

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Not treated.
R1-1608613 Discussion on SC-MTCH transmission in NB-IoT Huawei, HiSilicon
R1-1608614 Discussion on NPDCCH search space for multicast in NB-IoT Huawei, HiSilicon
R1-1608615 Discussion on collision handling for multicast in NB-IoT Huawei, HiSilicon
R1-1608616 Discussion on acknowledgement of SC-MTCH transmission in NB-IoT Huawei, HiSilicon
R1-1608883 SC-PTM seach space design for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608885 SC-MTCH transmission for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608941 Multicast Support for eNB-IoT Sony
R1-1609208 Multicast support for eNB-IoT LG Electronics
R1-1609481 Multicast support for NB-IoT Intel Corporation
R1-1609682 Considerations on SC-PTM in NBIoT Beijing Xinwei Telecom Techn.
R1-1609833 Considerations on multicast support for NB-IoT ZTE
R1-1609868 Further discussion on change notification of SC-PTM for NB-IoT Sharp
R1-1610019 Discussion on SC-PTM for NB-IoT MediaTek Inc.
R1-1610027 Discussion on multicast support for Rel-14 NB-IoT NTT DOCOMO, INC.
R1-1610222 On support of SC-PTM in NB-IoT Innovative Technology Lab Co., KT Corp.
R1-1610347 NB-IoT Collision handling in Multicast Ericsson
R1-1610469 Way Forward on SC-PTM configuration for eNB-IoT LG Electronics

7.2.9.3 Non-anchor PRB enhancements

Transmission of paging on non-anchor PRBs
R1-1608704 NB-IoT Paging on non-anchor PRBs Ericsson
R1-1608705 NB-IoT Paging Capacity Ericsson
R1-1608886 Random access on non-anchor PRB for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608887 Paging on non-anchor PRB for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1609209 Non-anchor PRB enhancements for eNB-IoT LG Electronics
R1-1609289 Considerations on multiple anchor PRBs for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1609357 On non-anchor carrier paging Huawei, HiSilicon
R1-1609482 Enhancements to paging on non-anchor PRBs Intel Corporation
R1-1609838 Remaining issues on multiple PRB support for NB-IoT ZTE
R1-1610003 Non-anchor PRB enhancements Qualcomm Incorporated
R1-1610206 Paging Transmission on Non-Anchor PRB III

R1-1610554 WF on the Presence of NRS on Non-anchor PRBs Ericsson, Nokia/Alcatel-Lucent Shanghai Bell
R1-1610470 WF on paging PRB configuration for eNB-IoT LG Electronics

7.2.9.4 Power consumption and latency reduction

Support in DL and UL for 2 HARQ processes and larger maximum TBS

R1-1608648 On 2 HARQ processes for enhancement of NB-IoT Huawei, HiSilicon
R1-1610020 Discussion on two HARQ process MediaTek Inc.
R1-1610430 Power consumption and latency reduction by increasing the maximum NPDSCH transport block sizes and using two HARQ Ericsson (Revision of R1-1610348)
R1-1610431 Power consumption and latency reduction by increasing the maximum NPUSCH transport block size and using two HARQ Ericsson (Revision of R1-1610349)

R1-1610645 WF on timing relationships of 2 HARQ processes for NB-IoT enhancement Huawei, HiSilicon
Further revised in:
R1-1610994 WF on timing relationships of 2 HARQ processes for NB-IoT enhancement Huawei, HiSilicon, Deutsche Telekom, Vodafone, China Unicom, IITH, CEWIT, IITM, Tejas Networks, Reliance Jio, Ericsson, ITL, Lenovo, Neul, Potevio, u-blox, Sony
Also supported by: Intel

Friday
R1-1611019 WF on timing relationship for 2 HARQ processes for Rel-14 NB-IoT MediaTek, Qualcomm, DoCoMo, AT&T, Softbank, ITRI, Sharp, MTI, APT, Xinwei, ZTE, ZTE Microelectronics, KDDI
Discussion: Concern from Intel/Huawei on the cost impact
Vodafone → support Huawei's view – would like to keep complexity level to the Rel-13 level
RAN1 chair: different views from other operators
MediaTek suggested having an email discussion how to evaluate the cost impact
Huawei: objection
MediaTek → can interested companies bring up analysis related to cost impact for both alternatives on the table (R1-1610994 & R1-1611019)? - Objective: cross compare the results between companies

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Decision: Continue discussions about R1-1610994 and R1-1611019 until the next meeting.

Agreement:
- Maximum DL TBS is 1352 bits
- Maximum UL TBS is 1800 bits
- The same values of N_SF and N_RU and I_TBS are used as in Rel-13

Email discussion to agree TBS/N_SF and TBS/N_RU tables until Friday October 21st (Olof, Ericsson).

Not treated.
R1-1608888 Supporting 2 HARQ processes for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1608889 Larger maximum TBS for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1609371 On larger TBS for enhancement of NB-IoT Huawei, HiSilicon
R1-1609372 DCI formats for enhancement of NB-IoT Huawei, HiSilicon
R1-1609834 Considerations on power consumption and latency reduction ZTE
R1-1610004 Support of larger TBS and 2 HARQ processes Qualcomm Incorporated
R1-1610021 Support of larger Max TBS MediaTek Inc.
R1-1610432 Power consumption and latency reduction by increasing the maximum NPDSCH transport block sizes Ericsson
R1-1610433 Power consumption and latency reduction by increasing the maximum NPUSCH transport block size Ericsson

7.2.9.5 Other

R1-1609210 Low power UE support for eNB-IoT LG Electronics
R1-1609837 Discussion for aspects of supporting Low Power class UE for NB-IoT ZTE

7.2.10 Shortened TTI and processing time for LTE - *WID in RP-161922.*

R1-1610873 Chairman's notes of AI 7.2.10 on Shortened TTI and processing time for LTE Ad-Hoc chair (Ericsson)
The document was presented by Daniel Larsson from Ericsson.
Decision: The document is endorsed and content incorporated below.

Friday
R1-1610584 [DRAFT] LS on Shortened TTI and processing time for LTE Ericsson
Decision: The document is noted and final LS is agreed in R1-1611055.

7.2.10.1 Shortened processing time for 1ms TTI

R1-1610042 Views on shortened processing time for 1ms TTI NTT DOCOMO, INC.

R1-1610543 WF on not supporting N+2 in 1ms TTI processing time reduction Qualcomm, CATT, Samsung, Huawei, HiSilicon, Intel, MTK, ZTE, ZTE Microelectronics
Also supported by: LGE

R1-1610557 WF on supporting n+2 minimum timing for shortened processing time in 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell, Ericsson, NTT DoComo, Sharp
Also supported by: Spreadtrum, Interdigital
Support a minimum timing of n+2 TTIs for FS1/2/3 for UL grant to UL data and for DL data to DL HARQ as a UE capability
- For n+2 timing, the maximum TA is reduced to 0.33ms
- PDCCH USS scheduling for n+2 timing is supported
  - FSS if EPDCCH scheduling is supported as an additional UE capability
- The supported DL peak data rate with n+2 timing is a UE capability
  - The peak data rate are given by DL UE category is scaled by Z
    - Z = (0.5, 0.75, 1)
- For PUCCH on FS1 cell, support a dynamic indication of n+2 and n+3 timing
  - Signaling details of indicating the different processing time for 1ms TTI is FFS
  - FSS support for PUCCH on FS2 cell
- FFS: For n+2 UL grant to PUSCH timing, the UL-SCH interleaving over all PUSCH SC-OFDMA symbols is removed

Conclusion
No consensus to support a minimum processing time of n+2

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Not treated.
R1-1608644 Design on shortened processing time for 1ms TTI Huawei, HiSilicon
R1-1608645 Performance evaluation of short TTI vs. 1ms TTI with processing time reduction Huawei, HiSilicon
R1-1608654 Processing time reduction and related HARQ timings with 1ms TTI for FS2 Huawei, HiSilicon
R1-1608741 HARQ and scheduling timing design for LTE processing timing reduction with 1ms TTI CATT
R1-1608912 Considerations for shortened processing time Spreadtrum Communications
R1-1608994 Overall operations for processing time reduction with 1ms TTI Samsung
R1-1608995 DCI for processing time reduction with 1ms TTI Samsung
R1-1608996 Fall-back mode operation for processing time reduction with 1ms TTI Samsung
R1-1608997 Discussion on processing time reduction with 1ms TTI Samsung
R1-1608998 CSI measurement and reporting for processing time reduction with 1ms TTI Samsung
R1-1608999 TDD DL HARQ-ACK feedback procedure for processing time reduction with 1ms TTI Samsung
R1-1609160 Latency Reduction for FS2 with 1-ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1609211 Remaining issues on shortened processing time for 1ms TTI LG Electronics
R1-1609212 Discussion on shortened processing time for FS2 LG Electronics
R1-1609213 Discussion on CSI feedback for 1ms TTI with shortened processing time LG Electronics
R1-1609315 On maximum TA and EPDCCH support for n+3 timing Nokia, Alcatel-Lucent Shanghai Bell
R1-1609316 On support of n+2 timing for 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1609317 Dynamic fall-back and required scheduling restrictions for 1ms TTI with different processing times Nokia, Alcatel-Lucent Shanghai Bell
R1-1609318 On DCI details for 1ms TTI UL asynchronous HARQ Nokia, Alcatel-Lucent Shanghai Bell
R1-1609319 Interaction between synchronous and asynchronous UL HARQ for 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1609320 On processing time reduction between PDSCH transmission and DL HARQ feedback Nokia, Alcatel-Lucent Shanghai Bell
R1-1609321 On processing time reduction between UL grant and UL data transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-1609339 Some issues in 1ms TTI with shortened processing time ZTE, ZTE Microelectronics
R1-1609340 HARQ with shortened processing time for 1ms TTI ZTE, ZTE Microelectronics
R1-1609484 On reducing processing time for 1ms TTI Intel Corporation
R1-1609821 Considerations on processing time reduction for legacy TTIs Mediatek Inc.
R1-1609869 Shortened processing time operation for 1ms TTI Sharp
R1-1609870 HARQ-ACK feedback for 1ms TTI with reduced processing time Sharp
R1-1610005 Shortened processing time for 1ms TTI for DL Qualcomm Incorporated
R1-1610006 Shortened processing time for 1ms TTI for UL Qualcomm Incorporated
R1-1610043 HARQ/Scheduling for shortened processing time for 1ms TTI NTT DOCOMO, INC.
R1-1610044 Views on CSI feedback for 1ms TTI with shortened processing time NTT DOCOMO, INC.
R1-1610339 Reduced processing for 1ms TTI Ericsson
R1-1610340 Fast CSI for 1ms TTI Ericsson
R1-1610341 HARQ and UL scheduling timings for 1ms TTI and reduced processing time Ericsson
R1-1610342 PUCCH collisions with reduced processing time for 1ms TTI Ericsson
R1-1610343 Asynchronous HARQ for PUSCH Ericsson
R1-1610542 Way Forward on maximum TA restriction for 1ms TTI processing time reduction Qualcomm Incorporated
R1-1610561 Way Forward on fallback mechanisms for shortened processing time in 1ms TTI LG Electronics, Ericsson, Intel, Qualcomm, Huawei, HiSilicon
R1-1610562 Way Forward on UL scheduling timing for FS2 with shortened processing time in 1ms TTI LG Electronics, NTT DOCOMO, Ericsson, ZTE Corp, ZTE Microelectronics, Intel
R1-1610568 Way Forward on DL HARQ-ACK timing for FS2 Samsung
R1-1610832 Way Forward on asynchronous UL HARQ in 1ms TTI LG Electronics, NTT DOCOMO

7.2.10.2 Shortened TTI length together with shortened processing time

R1-1609820 Considerations on short TTI design Mediatek Inc.
R1-1609822 UL RS design for short TTI Mediatek Inc.
R1-1609823 DL DMRS and DCI design for short TTI Mediatek Inc.
R1-1610569 Way Forward on sTTI length Samsung, Panasonic, Qualcomm, Sharp, ZTE, ZTE Microelectronics
R1-1610788 Way Forward on supporting multiplxing sDCI with different AL in one sPDCCH Qualcomm

7.2.10.2.1 Design of sTTI for DL and UL

R1-1609161 Considerations on Asymmetric DL&UL sTTI Length Operations Nokia, Alcatel-Lucent Shanghai Bell
R1-1608631 Discussion on sTTI structure Huawei, HiSilicon

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Proposed agreements:

- In DL no sTTI spans over slot boundary
- In DL TTI can span over slot boundary
- In UL no sTTI spans over slot boundary
- In UL TTI can span over slot boundary

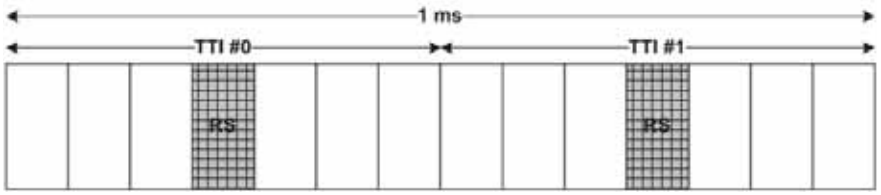
Agreement:

- Short TTI is not configured with extended CP.

R1-1610563 WF on short TTI structure LG Electronics, Huawei, HiSilicon

Agreement:

- For 7-symbol TTI, the following sTTI structure is supported for UL



R1-1610833 WF on UL short TTI structure LG Electronics, Huawei, HiSilicon, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, NTT DOCOMO, Sharp, ZTE, ZTE Microelectronics, Intel, Qualcomm, CATT

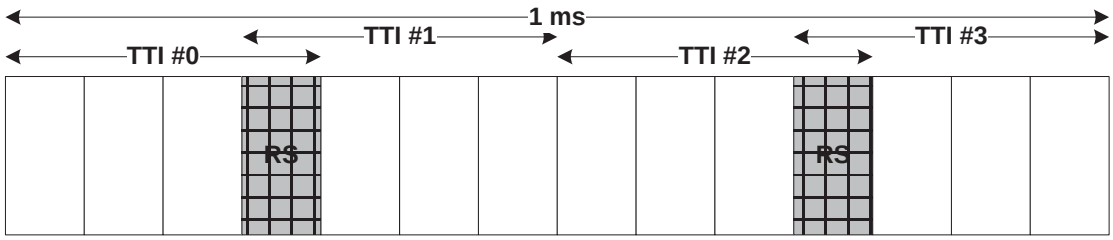
Agreement:

- For 2-symbol TTI, RAN1 will down-select UL sTTI structure among the following options:
  - Option 1: fixed sTTI structure
    - The data symbol(s) for sPUSCH are confined within a sTTI. Note that the DMRS for one sTTI may be placed within or outside the sTTI.
    - Option 1a: without spanning over slot boundary
      - The presence (if any) and the position of the UL DMRS is given by the UL grant,
        - If the UL DMRS is present it can be positioned before, within or after the sTTI
      - Considered sTTI patterns in OFDM symbols per subframe
        - Alt1: (2, 2, 3, 2, 2, 3)
        - Alt2: (3, 2, 2, 2, 2, 3)
        - Alt3: (3, 2, 2, 3, 2, 2)
    - Option 1b: a sTTI can span over slot boundary
      - Considered sTTI patterns in OFDM symbols per subframe
        - Alt1: (2, 2, 2, 2, 2, 2, 2)
  - Option 2: fixed nominal sTTI starting points and a possibility to delay the start of the transmission by N symbols with an indication in the UL grant
    - The presence (if any) and the position of the UL DMRS is given by the UL grant,
      - If the UL DMRS is present it can be positioned before, within or after the sTTI
    - The nominal sTTI starting point is determined by n+k processing time and DL sTTI structure

R1-1610834 WF on UL short TTI structure for 4-symbol sTTI LG Electronics, Samsung, Ericsson, CATT, NTT DOCOMO, ZTE, ZTE Microelectronics, Huawei, HiSilicon, Panasonic, Sharp

Agreement:

- If 4-symbol UL sTTI is supported, the following sTTI structure is adopted:



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R1-1610856 WF on sTTI length for DL Samsung, Ericsson, Sharp, NTT DOCOMO, Huawei, HiSilicon, Intel, CATT, ZTE, ZTE Microelectronics, LG Electronics

Agreement:

- The DL sTTI length of a UE is configured by RRC signaling.
  - FFS on whether different DL sTTI lengths for a given UE can be configured for different serving cells or not.

R1-1610827 WF on DL sTTI pattern Huawei, HiSilicon, NTT DOCOMO, Intel, Qualcomm, Ericsson, LGE, Sharp

Conclusion

- Aspects to consider when downselecting between the 2OS DL sTTI in R1-1610827
  - Orphan symbol sTTI
  - Support of distributed resource block allocation together with sTTI operation
  - Slot based sTTI operation together with 2 symbol sTTI operation
  - CSI-IM
  - Varying number of shortened TTI within a subframe
  - PCFICH detection error
  - HARQ timing
    - Achievable minimum HARQ/scheduling timing with varying sTTI length
  - UL sTTI structure
  - Other aspects can also be considered

R1-1610855 WF on the combination of sTTI length for DL and UL Samsung, Qualcomm

Agreement:

- For the combination of sTTI for DL and UL, RAN1 chooses one to be supported among the following alternatives.
  - Alt 1. {2,2}, {7,7}
  - Alt 2. {2,2}, {2,4}, {7,7}
  - Alt 3. {2,2}, {2,7}, {7,7}
  - Alt 4. {2,2}, {2,4}, {2,7}, {7,7}
  - Note: {a,b} denotes {DL sTTI length, UL sTTI length}.
  - Note: DL sTTI length is used for sPDCCH and sPDSCH.
  - Note: UL sTTI length is used for sPUSCH and sPUCCH corresponding to sPDCCH and sPDSCH, respectively.
- RAN1 study the necessity of {2,14} and/or {7,14}

R1-1610583 Way Forward on sTTI scheduling options Ericsson, Huawei, HiSilicon (Revision of R1-1610582)

Agreement

- Select a sTTI scheduling scheme among the following candidates for each sTTI length
  - Single level DCI
    - RRC configuration of sPDCCH search space and/or sPDCCH frequency region
    - UE-specific information in sDCI related to sPDSCH/sPUSCH
  - Two level DCI
    - RRC configuration may or may not at least partially indicate sPDCCH frequency region/search space for some of the variants described below
    - variant 1
      - Slow DCI: non UE-specific information in PDCCH
      - Fast DCI: UE-specific information in sDCI
    - variant 2
      - Slow DCI: UE-specific information in PDCCH
      - Fast DCI: UE-specific information in sDCI
    - variant 3
      - Slow DCI: UE-specific information in PDCCH and/or sPDCCH
      - Fast DCI: UE-specific information in sDCI
  - Note: the sTTI scheduling scheme may be the same or different for different sTTI length
- FFS how to reduce the payload of sDCI/DCI messages for sTTI operation
- FFS support of multi-sTTI scheduling
- Additional L1 signaling related to sTTI operation can be considered

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R1-1610787 WF on transmission modes for sTTI Huawei, HiSilicon, CMCC, Softbank, Qualcomm, Intel, CATT

Agreement:

- For DL transmission for sTTI
  - TM1, 2, 3, 4, 6, 9, 10 are supported for FS1.
  - TM1, 2, 3, 4, 6, 8, 9, 10 are supported for slot based sTTI for FS2.
  - Note: For 2 symbol sTTI design TM8 is not supported in this WI
- For UL transmission for sTTI
  - TM1 and TM2 are supported

R1-1610338 Draft LS on UL power control related aspects Ericsson

Friday
R1-1610585 [DRAFT] LS on implication of sTTI operation on UL ON/OFF time mask Ericsson
Decision: The document is noted and final LS is agreed in R1-1611054.

R1-1610329 Design aspects of sPUCCH Ericsson

Not treated.

R1-1608632 Discussion on CRS based sPDCCH Huawei, HiSilicon
R1-1608633 Discussion on DMRS-based sPDCCH Huawei, HiSilicon
R1-1608634 Details of two-level DCI schemes for short TTI Huawei, HiSilicon
R1-1608635 Discussion on DCI design for short TTI Huawei, HiSilicon
R1-1608636 Discussion on sPDSCH design Huawei, HiSilicon
R1-1608637 Discussion on sPUCCH design Huawei, HiSilicon
R1-1608638 Discussion on sPUSCH design Huawei, HiSilicon
R1-1608639 UCI on sPUSCH Huawei, HiSilicon
R1-1608640 Handling collision between sTTI and 1ms TTI Huawei, HiSilicon
R1-1608641 Discussion on UL RS for short TTI Huawei, HiSilicon
R1-1608653 Discussion on CA issues for shortened TTI operation Huawei, HiSilicon
R1-1608656 Discussion on sPUCCH resource for shortened TTI Huawei, HiSilicon
R1-1608742 On sDCI design CATT
R1-1608743 Design of sPDCCH structure CATT
R1-1608744 Other issues for sPDCCH design CATT
R1-1608745 DL/UL sTTI partition CATT
R1-1608746 DMRS design for sPUSCH CATT
R1-1608747 DMRS design for DL sTTI CATT
R1-1608748 On efficient multiplexing of normal TTI and sTTI CATT
R1-1608749 Discussion on UL sTTI operation CATT
R1-1608750 sPUCCH design for sTTI CATT
R1-1608751 Discussion on the simultaneous transmissions of (s)PUCCH and (s)PUSCH CATT
R1-1608752 UCI transmission for LTE sTTI CATT
R1-1608913 Discussion on sPDCCH design for sTTI Spreadtrum Communications
R1-1608914 Discussion on sPUSCH design for sTTI Spreadtrum Communications
R1-1608915 Discussion on DL RS design for sTTI Spreadtrum Communications
R1-1608946 Discussion on sPDCCH for shortened TTI Sony
R1-1609000 Overview of sTTI operations Samsung
R1-1609001 sDCI for sTTI operation Samsung
R1-1609002 sPDCCH for 2-symbol sTTI Samsung
R1-1609003 sPDCCH for 1-slot sTTI Samsung
R1-1609004 sPDSCH for 2-symbol/1-slot sTTI Samsung
R1-1609005 sPUCCH for 2-symbol, 4-symbol, 1-slot sTTI Samsung
R1-1609006 sPUSCH for 2-symbol, 4-symbol, 1-slot sTTI Samsung
R1-1609007 TDD-specific issues on sTTI operation Samsung
R1-1609008 Coexistence between 1ms TTI and sTTI operations for DL/UL Samsung
R1-1609157 sPDSCH/sPDCCH with 2-symbol sTTI and 1-slot sTTI NEC
R1-1609162 Simultaneous Transmissions of UL Signals for Shortened TTI Operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1609163 On signaling details for flexible DMRS in UL shorter TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1609164 sPUCCH Design for shortened TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1609165 Considerations of slot-level sTTI for FS2 Nokia, Alcatel-Lucent Shanghai Bell

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R1-1609214 Discussions on sPDCCH for latency reduction LG Electronics
R1-1609215 Discussions on sPDSCH for latency reduction LG Electronics
R1-1609216 sPUCCH for HARQ-ACK in shortened TTI LG Electronics
R1-1609217 sPUCCH for CSI in shortened TTI LG Electronics
R1-1609218 Discussion on CA operations for latency reduction LG Electronics
R1-1609219 Discussion on sTTI designs for UL LG Electronics
R1-1609298 Discussion on HARQ timing for shortened TTI in TDD CMCC
R1-1609322 On DL control channel design for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1609323 On two-level DL control channel design and subframe structure for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1609324 On design of search space for short PDCCH Nokia, Alcatel-Lucent Shanghai Bell
R1-1609325 On details of flexible DMRS design for DL shorter TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1609341 Discussion on sPDCCH for sTTI ZTE, ZTE Microelectronics
R1-1609342 Discussion on PUCCH design for sTTI ZTE, ZTE Microelectronics
R1-1609343 Study on PDSCH transmission in sTTI ZTE, ZTE Microelectronics
R1-1609374 Study on PUSCH transmission in sTTI ZTE, ZTE Microelectronics
R1-1609375 Simultaneous transmission and reception in sTTI ZTE, ZTE Microelectronics
R1-1609485 DCI formats for shorten TTI Intel Corporation
R1-1609486 On sPDCCH design for shoten TTI Intel Corporation
R1-1609487 UL design aspects of TTI shortening Intel Corporation
R1-1609572 Discussion on reference signal design for shortened TTI Panasonic
R1-1609573 Discussion on multiplexing between sTTI and TTI in the same subframe Panasonic
R1-1609574 UL simultaneous transmission between sTTI and TTI Panasonic
R1-1609575 Discussion on single level DCI and two-level DCI Panasonic
R1-1609908 Considerations on DCI design for shortened TTI Beijing Xiaomi Mobile Software
R1-1609914 Shortened TTI design Motorola Mobility
R1-1609915 Multiplexing of Regular TTI and shortened TTI Motorola Mobility
R1-1609916 CSI aspects of shortened TTI operation Motorola Mobility
R1-1610007 Dl design for shortened TTI Qualcomm Incorporated
R1-1610008 UL design for shortened TTI Qualcomm Incorporated
R1-1610045 s(E)PDCCH for shortened TTI NTT DOCOMO, INC.
R1-1610046 sPDSCH for shortened TTI NTT DOCOMO, INC.
R1-1610047 sPUCCH for shortened TTI NTT DOCOMO, INC.
R1-1610048 sPUSCH for shortened TTI NTT DOCOMO, INC.
R1-1610093 sPDCCH design for short TTI HTC Corporation
R1-1610096 On sPDCCH Design InterDigital Communications
R1-1610097 On sPDSCH Design InterDigital Communications
R1-1610098 On sPUCCH Design InterDigital Communications
R1-1610099 On sPUSCH Design InterDigital Communications
R1-1610230 Discussion on HARQ Process for Slot-based TTI ASUSTEK COMPUTER (SHANGHAI)
R1-1610305 Design aspects of short PUSCH KT Corp.
R1-1610321 DL DMRS design for TTI shortening Ericsson
R1-1610322 sPDCCH search space design Ericsson
R1-1610323 Design aspects of sPDCCH Ericsson
R1-1610324 DL control for short TTI Ericsson
R1-1610325 Design aspects of sPDSCH Ericsson
R1-1610326 Design aspects of sPUSCH Ericsson
R1-1610327 sPUSCH sTTI operation Ericsson
R1-1610331 On the operation with different TTI lengths Ericsson
R1-1610332 TDD aspects of short TTI Ericsson
R1-1610333 sTTI lengths combination in case of CA Ericsson
R1-1610334 Asynchronous HARQ for UL retransmissions with short TTI Ericsson
R1-1610335 Handling overlapping allocations with short and 1 ms TTI Ericsson
R1-1610336 Puncturing sTTI in legacy TTI Ericsson
R1-1610337 UL power-related aspects for sTTI Ericsson
R1-1610344 TBS scaling for short TTI Ericsson
R1-1610473 UCI on sPUSCH with short TTI Ericsson
R1-1610548 Way Forward on sTTI scheduling options Ericsson
R1-1610549 Way Forward on handling of overlapping PDSCH/sPDSCH and PUSCH/sPUSCH Ericsson
R1-1610564 Way Forward on sPUCCH design LG Electronics, ZTE Corp, ZTE Microelectronics
R1-1610581 Way Forward on handling of PUSCH and sPUSCH grants for the same subframe and carrier Ericsson, Huawei, HiSilicon
R1-1610616 Way Forward on DL DMRS for sTTI Huawei, HiSilicon
R1-1610617 Way Forward on UL DMRS indication for sTTI Huawei, HiSilicon

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R1-1610618 Way Forward on sDCI Huawei, HiSilicon
R1-1610619 Way Forward on sPUCCH formats Huawei, HiSilicon
R1-1610620 Way Forward on sPUCCH patterns Huawei, HiSilicon
R1-1610814 DMRS-based sPDCCH ZTE
R1-1610835 Way Forward on sTTI scheduling options Ericsson, Panasonic, Samsung, Nokia, ASB, ZTE, ZTE Microelectronics, CATT, LG Electronics
R1-1610836 Way Forward on handling of PDSCH/sPDSCH assignments for the same subframe and carrier Ericsson, Huawei, HiSilicon, Qualcomm, NTT DOCOMO, LG Electronics

7.2.10.2.2 Processing time

Including maximum TA, CSI processing and minimum data processing time

R1-1608642 Discussion on CSI feedback for short TTI Huawei, HiSilicon
R1-1608643 Processing time reduction and related procedures for short TTI Huawei, HiSilicon
R1-1608646 TDD-specific design for short TTI Huawei, HiSilicon
R1-1608753 Implicit HARQ and scheduling timing design for LTE sTTI CATT
R1-1609009 Processing time reduction for sTTI operation Samsung
R1-1609220 Shortened processing time for shortened TTI length LG Electronics
R1-1609221 HARQ timing in shortened TTI LG Electronics
R1-1609376 Processing time reduction and related procedures ZTE, ZTE Microelectronics
R1-1609488 On the processing time reduction for latency reduction Intel Corporation
R1-1609871 Association timing for sTTI with different UL and DL lengths Sharp
R1-1609872 Processing time reduction for TDD with 1-slot sTTI Sharp
R1-1610009 Processing time reduction and related procedures for DL Qualcomm Incorporated
R1-1610010 Processing time reduction and related procedures for UL Qualcomm Incorporated
R1-1610011 TDD-specific design for shortened TTI Qualcomm Incorporated
R1-1610049 Views on processing time reduction and related procedures NTT DOCOMO, INC.
R1-1610050 Views on CSI feedback for shortened TTI with reduced processing time NTT DOCOMO, INC.
R1-1610100 Processing Time Reduction for sTTI InterDigital Communications
R1-1610330 On reduced processing time for short TTI Ericsson
R1-1610444 Explicit HARQ and scheduling timing design for LTE shorten TTI CATT

7.2.10.3 Other

R1-1609405 On the carrier aggregation system supporting shortened TTI operation ITRI
R1-1609406 Discussion on the power headroom reporting for shortened TTI operation ITRI
R1-1610012 Link evaluation of DL data transmission under symbol-dependent impact Qualcomm Incorporated

7.2.11 Performance enhancements for high speed scenario - *WID in RP-152263.*

R1-1610874 Chairman's notes of AI 7.2.11 on Performance enhancements for high speed scenario Ad-Hoc chair (Qualcomm)

The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is endorsed and content incorporated below.

R1-1609349 Restricted sets of cyclic shifts for PRACH in high speed scenario Huawei
R1-1609350 On the support for legacy UEs in high speed cells Huawei
R1-1609929 Introduction of PRACH enhancement for high speed scenario Huawei
R1-1610013 PRACH enhancements Qualcomm Incorporated
R1-1610223 PRACH for very high speed scenario Nokia, Alcatel-Lucent Shanghai Bell

R1-1610903 WF on Performance enhancements for high speed scenario Huawei, HiSilicon, Nokia, ASB, NTT DOCOMO

Agreements:

- Set 3 in R1-1609349 is selected as the new restricted set of cyclic shifts for PRACH in the new Rel-14 high speed scenario.
- Two sets of PRACH resources are configured for a cell that supports the new Rel-14 high speed scenario:
  - One set optimized for new Rel-14 high speed scenario and signaled to Rel-14 UEs. RAN1 recommends that this set is configured by the following new RRC parameters:
    - highSpeedFlag-r14
    - zeroCorrelationZoneConfig-r14
    - rootSequenceIndex-r14
  - The other set signaled to Rel-8 – Rel-13 UEs.

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R1-1610985 **[DRAFT] Reply LS on A New PRACH Cyclic Shift Restriction Set Huawei**
Decision: The document is noted and final LS is agreed in R1-1611056

7.2.12 Voice and Video enhancement for LTE - *WID in RP-161856*

VoLTE coverage enhancement
R1-1610875 **Chairman's notes of AI 7.2.12 on Study on Enhancement of VoLTEAd-Hoc chair (Qualcomm)**
The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is endorsed and content incorporated below.

R1-1609565 **Specification impact of VoLTE/ViLTE coverage enhancements China Telecommunications**
R1-1610396 **PUSCH coverage enhancement for VoLTE Ericsson**
R1-1608606 **Discussion on VoLTE coverage enhancement Huawei, HiSilicon**
R1-1609723 **VoLTE coverage enhancement Nokia, Alcatel-Lucent Shanghai Bell**

Companies are encouraged to check:
- what aspects of quality are to be enhanced
- what maximum transport block size is envisaged
- why ViLTE is not included in the coverage enhancement part of the WID.

R1-1610921 **WF on VoLTE and ViLTE enhancement Huawei, HiSilicon, China Telecommunications**
Also supported by CMCC

Agreements:
- HARQ process ID of PUSCH is indicated in DCI
- Re-use the eMTC repetition scheme, i.e.:
  - Support numbers of repetitions for PUSCH not larger than X
    - FFS the value of X considering the relaxed delay budget, and X may be different from the largest value in eMTC
  - A set of [4 or 8 (TBD)] numbers of repetitions are configured by RRC signalling of the maximum number of repetitions
  - The number of repetitions of PUSCH is indicated in DCI
- Re-use eMTC frequency hopping scheme, i.e.:
  - The frequency domain hopping offset and the time domain hopping interval are cell specific
  - The time domain hopping interval is configured as one of
    - {1, 2, 4, 8} subframes for FDD
    - {1, 5, 10, Y} subframes for TDD, where Y is TBD after deciding the value of X
  - FFS: values of frequency domain hopping offset

R1-1610606 **Draft LS for Voice and Video enhancement for LTE Huawei**
Decision: The document is noted and final LS is agreed in R1-1611057

R1-1610438 Coverage enhancement techniques Qualcomm Incorporated (R1-1610014)

7.2.13 Study on Further enhancements to Coordinated Multi-Point Operation - *SID in RP-160954*

R1-1610876 **Chairman's notes of AI 7.2.13 on Study on Further enhancements to Coordinated Multi-Point Operation Ad-Hoc chair (Intel)**
The document was presented by Alexey Davydov from Intel.
Decision: The document is endorsed and content incorporated below.

R1-1608609 TP for 36.741 on definition and classification of non-coherent JT Huawei, HiSilicon
R1-1610299 **TP on TR 36.741 Study on FeCoMP ZTE, ZTE Microelectronics**

Agreement:
- Endorse TP in R1-1610299

7.2.13.1 Initial evaluation results and enhancements for non-coherent joint transmission

R1-1608610 **Potential enhancements and specification impact analysis of non-coherent JT Huawei, HiSilicon**
R1-1608692 **Potential Enhancement on the Non-coherent JT ZTE, ZTE Microelectronics**
R1-1608694 Initial evaluation results of non-coherent JT ZTE, ZTE Microelectronics

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R1-1608933 Discussion and Preliminary Simulation Results of NCJT Case 1 of FeCoMP Nokia, Alcatel-Lucent Shanghai Bell
R1-1609010 Initial evaluation results and enhancements for non-coherent JT Samsung
R1-1609355 Simulation results of non-coherent JT Huawei, HiSilicon
R1-1609489 CSI feedback enhancements for non coherent JT Intel Corporation
R1-1609490 Control signalling enhancements for non coherent JT Intel Corporation
R1-1609491 System level evaluation results for non coherent JT Intel Corporation
R1-1609715 QCL Issues of Joint Transmission ZTE, ASTRI
R1-1609863 Non-Coherent JT Enhancements Ericsson
R1-1610016 Enhancements for non-coherent JT Qualcomm Incorporated
R1-1610819 WF on potential enhancements for non-coherent joint transmission ZTE, ZTE Microelectronics, Intel, ASTRI, Huawei, HiSilicon, Nokia, ASB

Agreements:

- At least the following enhancements should be studied for NCJT:
  - Enhancement to QCL assumptions for DM-RS antenna ports
    - e.g., non co-located DM-RS antenna ports
  - Control signalling enhancements
    - e.g., One DCI or multiple DCIs to support CW-specific resource allocation / MCS assignment / PDSCH RE mapping, more than one CSI-RS resource for QCL/ CW-to-layer mapping
  - CSI enhancements
    - e.g., CSI calculation for multiple CSI processes with dependency among CSI processes
    - e.g., CSI calculation for single CSI process with codebook enhancement
    - e.g., CSI calculation for single CSI process with dependency among K CSI-RS resource in Class B FD-MIMO
    - e.g., Support of the CSI for advanced receivers
  - Enhancement to channel/interference measurements
    - e.g., interference measurements based on NZP CSI-RS
    - e.g., aperiodic CSI-IM
    - e.g., measurement restriction in the frequency domain

7.2.13.2 Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO

R1-1608611 Potential enhancements and specification impacts for CS/CB with FD-MIMO Huawei, HiSilicon
R1-1608695 Initial evaluation results for CS/CB ZTE, ZTE Microelectronics
R1-1608696 Potential enhancements for CS/CB with FD-MIMO ZTE, ZTE Microelectronics
R1-1609011 Initial evaluation results and enhancements for CS/CB with FDMIMO Samsung
R1-1609356 Simulation results of CS/CB with FD-MIMO Huawei, HiSilicon
R1-1609492 Enhancements and system level evaluation of CS/CB CoMP for FD-MIMO Intel Corporation
R1-1609864 Further results on CS/CB in indoor scenario Ericsson
R1-1610017 Enhancements for coordinated scheduling/beamforming with FD-MIMO Qualcomm Incorporated
R1-1610782 WF on enhancement of CS/CB with FD-MIMO Huawei, HiSilicon, Intel, SoftBank Corp, ZTE, ZTE Microelectronics, Samsung

Agreements:

- At least the following enhancements should be studied for CS/CB enhancement:
  - CSI feedback enhancement
    - e.g. CSI feedback reflect different interference beamforming hypothesis from coordinated TPs .
    - e.g. CSI feedback considering power adjustment
    - e.g. only CSIs regarding TPs with strong interference are reported
  - Interference measurement enhancements
    - e.g. NZP CSI-RS used for measuring interference from coordinated TP.
    - e.g. aperiodic CSI-IM
    - e.g. measurement restriction in the frequency domain
  - Enhancement to non ideal backhaul
    - e.g. PMI/CRI signalling between eNBs
  - Enhancement to reference signals
    - e.g. support of orthogonal DM-RS ports for multi-point MU-MIMO
    - e.g. SRS configuration signalling between eNBs
    - e.g. Multiplexing of CSI-RS resources with IC
    - e.g. Resource pool sharing for channel and interference measurement
  - QCL enhancement
    - e.g. non co-located CSI-RS resources in Class B FD-MIMO

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- Enhancement to SRS:
  - e.g. enable eNB to measure the SRS from interfering UE(s).

8 NR

Friday morning: "Funny" debate on the definition and content of the wording "study"
Background came from Ericsson commenting that they would like to avoid ending-up to a situation where company(ies) say(s) "this topic has not been studied" and consequently SI is not completed and needs to be postponed.
Nokia also agreed to Ericsson's comment
Chair→ Study does not necessarely have to reach a conclusion
RAN1 chair agreed with Ericsson/Nokia views and would like to avoid having the same kind of issue raised at the plenary.

8.1 Study on New Radio Access Technology - SID in RP-161596

Additional RAN guidance in RP-161914

Wednesday
R1-1610053 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
The document was presented by Kazuaki Takeda from NTT DOCOMO.
Discussion: Huawei couldn't check whether remarks sent on the reflector have been captured
Decision: The document is noted. All proponents are encouraged to check it until Thursday morning.
Thursday
R1-1610843 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
Decision: The document (TR38.802 v0.2.1) is noted and endorsed as version 0.3.0 in R1-1610848 as basis for future updates.

R1-1610052 Workplan for Study on NR Access Technology NTT DOCOMO, INC.

8.1.1 Waveform and multiple access schemes for new radio interface

R1-1610877 Chairman's notes of AI 8.1.1 on waveform and multiple access schemes for NR Ad-Hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is endorsed and content incorporated below.

8.1.1.1 Waveform

Summarize the waveform study including conclusions of Phase I

R1-1608709 Optimized PAPR/CM SC-CPS Waveform and Further Results Idaho National Laboratory
R1-1608829 Uplink coverage performance of OFDM with PAPR reduction for below 6 GHz Huawei, HiSilicon
R1-1609034 Evaluation results of Low PAPR waveform Samsung
R1-1609222 Discussion on DFT-s-OFDM and CP-OFDM for Uplink LG Electronics
R1-1609299 Discussion and evaluation of UL Waveforms CMCC
R1-1609378 A New DFTS-OFDM Compatible Low PAPR Technique for NR Uplink Waveforms MediaTek
R1-1609384 Network Assisted Waveform Selection for NR AT&T GNS Belgium SPRL
R1-1609390 Low PAPR Waveform Design for NR IITH
R1-1609567 On UL Waveforms below 40 GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-1609813 Uplink waveform evaluations and proposals for NR Phase 1 Panasonic Corporation
R1-1610054 Views on UL waveform for NR NTT DOCOMO, INC.
R1-1610113 Coverage analysis of DFT-s-OFDM and OFDM with low PAPR techniques Qualcomm Incorporated
R1-1610224 Coexistence of DFTsOFDM and OFDM in UL below 40GHz Mitsubishi Electric RCE
R1-1610446 OTFS PAPR Analysis Cohere Technologies (Revision of R1-1610397)

R1-1610485 WF on Waveform for NR Uplink Qualcomm, Orange, OPPO, ZTE, ZTE Microelectronics, InterDigital, MediaTek, LGE, IITH, Idaho National Lab, Mitsubishi, Panasonic, Vivo, Tejas Networks, IITM, CEWIT, Straight Path, NTU, Kyocera, Samsung, Spreadtrum, Reliance-jio, Sharp, AT&T, Xiaomi, Sony, NEC, Motorola, Lenovo, National Instrument, Apple
Also supported by Dish Network

Agreement:
- NR Support DFT-S-OFDM based waveform complementary to CP-OFDM waveform, at least for eMBB uplink for up to 40GHz

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- FFS additional low PAPR techniques
- CP-OFDM waveform can be used for a single-stream and multi-stream (i.e. MIMO) transmissions, while DFT-S-OFDM based waveform is limited to a single stream transmissions (targeting for link budget limited cases)
- Network can decide and communicate to the UE which one of CP-OFDM and DFT-S-OFDM based waveforms to use
  - Note: both CP-OFDM and DFT-S-OFDM based waveforms are mandatory for UEs

- RAN1 should target for a common framework in designing CP-OFDM and DFT-S-OFDM based waveforms (without compromising CP-OFDM performance/complexity), e.g., control channels, RS, etc.
- Discuss further offline for possible refined evaluation assumptions/methodology for waveform evaluations

Not treated.

R1-1608800 Discussion on real domain OFDM for mMTC Fujitsu
R1-1608825 Low-complexity filter implementation for f-OFDM Huawei, HiSilicon
R1-1608826 Delay analysis for f-OFDM Huawei, HiSilicon
R1-1608827 Analysis of guard band for FDM of different numerologies in a NR carrier Huawei, HiSilicon
R1-1608828 Overview of PAPR reduction techniques Huawei, HiSilicon
R1-1608868 Analysis of spectral utilization in a NR carrier Huawei, HiSilicon
R1-1608916 Further considerations on waveform configuration Spreadtrum Communications
R1-1609033 Discussion on Low PAPR waveform for UL Samsung
R1-1609035 Evaluation results of guard-band supporting methods Samsung
R1-1609383 Summary of Link level analysis of candidate waveforms for NR AT&T GNS Belgium SPRL
R1-1609419 In-band Tx requirements for FDM of different numerologies in a NR carrier Huawei, HiSilicon
R1-1609420 In-band Rx requirements for FDM of different numerologies in a NR carrier Huawei, HiSilicon
R1-1609493 Single carrier based waveform for high frequency bands above 40 GHz Intel Corporation
R1-1609494 Further discussion on GI-DFT-s-OFDM for high frequency bands above 40 GHzIntel Corporation
R1-1609495 Views on multiple NR waveform proposals for high bands Intel Corporation
R1-1609496 Considerations on NR waveform with improved spectral containment Intel Corporation
R1-1609564 Implementation-specific UF-OFDM for New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1609568 Out of band emissions, in-band emissions and EVM requirement considerations for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1609597 Waveform proposal for carrier frequencies beyond 40 GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-1609598 Potential for system level gains for low-PAPR waveforms Nokia, Alcatel-Lucent Shanghai Bell
R1-1609599 Way forward waveform for carrier frequencies beyond 40 GHz Nokia, Alcatel-Lucent Shanghai Bell, Mitsubishi Electric, InterDigital Communications
R1-1609778 Further discussions on FB-OFDM ZTE, ZTE Microelectronics
R1-1609779 Further evaluations on FB-OFDM ZTE, ZTE Microelectronics
R1-1609780 Text Proposal on TR38.802 for NR waveform ZTE, ZTE Microelectronics
R1-1609792 mmWave UW DFTsOFDM link level evaluation Mitsubishi Electric
R1-1609825 OTFS Performance in High Doppler with Varying Subcarrier Spacing Cohere Technologies
R1-1609887 Coexistence of CP OFDM and CP DFT-s-OFDM for NR UL InterDigital Communications
R1-1609889 Waveform design considerations for carrier frequencies above 40 GHz InterDigital Communications
R1-1610015 Specification impact of DFTs-OFDM vs OFDM Qualcomm Incorporated
R1-1610107 Precoder flexibility and forward compatibility of CPS-OFDM waveform National Taiwan University
R1-1610108 Evaluation results of CPS-OFDM waveform National Taiwan University
R1-1610111 Phase I Waveform proposal: CP-OFDM plus DFT-s-OFDM Qualcomm Incorporated
R1-1610112 On the impact of beamforming to link budget comparison of DFTs-OFDM and OFDM Qualcomm Incorporated
R1-1610114 User Multiplexing of DFTs-OFDM and OFDM in uplink Qualcomm Incorporated
R1-1610116 UL waveform considerations for mmW Qualcomm Incorporated
R1-1610117 Common PAPR reduction techniques for OFDM / DFT-s-OFDM Qualcomm Incorporated
R1-1610238 FC-OFDM discussion based on RAN1#86 agreement ORANGE
R1-1610309 flexi-OFDMA, a new waveform for NR CEWiT, IIT-H, IIT-M, Reliance Jio, Tejas Networks
R1-1610403 Waveform Simulation Results for Above 40 GH Nokia, Alcatel-Lucent Shanghai Bell
R1-1610441 On UL waveform - evaluation Ericsson

8.1.1.2 Multiple access scheme

Summarize the multiple access scheme study and preliminary conclusions of Phase I

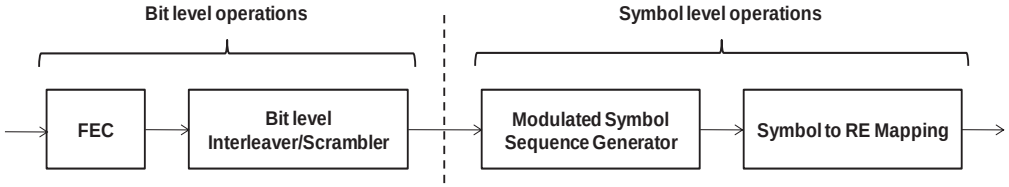
R1-1608802 DM-RS considerations for UL non-orthogonal multiple access Fujitsu
R1-1608869 Grant-free Non-orthogonal MA for uplink URLLC Huawei, HiSilicon

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R1-1608919 Considerations on pre-configured resource for grant-free based UL non-orthogonal MA Spreadtrum Communications
R1-1608954 Physical layer abstraction method for MMSE-SIC type receiver ZTE
R1-1609039 Support of HARQ in grant-free based multiple access Samsung
R1-1609228 General procedures on grant-free/grant-based MA LG Electronics
R1-1609334 System level evaluation result on RDMA MediaTek Inc.
R1-1609398 Uplink Grant-free Access for 5G mMTC Lenovo
R1-1609497 Link-level analysis of UL NOMA schemes Intel Corporation
R1-1609549 Comparison of OFDMA vs LSSA system level UL performance ETRI
Further revised in R1-1611023
R1-1609581 Initial system level simulation results of new multiple access scheme CATR
R1-1609783 Transmission Options for the mMTC Grant-Free Uplink Nokia, Alcatel-Lucent Shanghai Bell
R1-1610120 System level simulation results for proposed multiple access scheme Qualcomm Incorporated
R1-1610213 On Low Latency UL Multiple Access in NR Ericsson

R1-1608956 Summary of [86-18] email discussion on categorization for NR MA schemes ZTE
R1-1610801 WF on Observation of MA Signature ZTE, ZTE Microelectronics, Huawei, HiSilicon, ETRI
R1-1610956 WF on Common Features and General Framework of MA Schemes Huawei, HiSilicon, CATR, CATT, CMCC, Samsung, ETRI, MediaTek
Also supported by DCM

Agreements:
- Capture the following observations in the TR
  - All proposed non-orthogonal MA schemes for UL transmission share the following common features:
    - At the transmitter side: using MA signature(s)
    - At the receiver side: allowing multi-user detector
  - All proposed non-orthogonal MA schemes for UL transmission on a high level follow the following basic diagram. Note that the basic diagram is not intended to capture all the details or to be a complete diagram.



R1-1610528 WF on support of UL non-orthogonal multiple access Huawei, HiSilicon, Convida Wireless, Interdigital
R1-1610529 WF on support of UL grant-free Huawei, HiSilicon, CATT, Convida Wireless, Interdigital

R1-1610625 WF on TP Structure for NR Multiple Access in TR 38.802 ZTE, ZTE Microelectronics, Qualcomm Inc

Agreements:
- To add Section 8.1.3 for multiple access scheme for UL concept
  - Details subsections/contents/descriptions to be discussed offline

R1-1610626 WF on PHY abstraction method for MMSE-SIC/PIC receiver ZTE, ZTE Microelectronics

Agreements:
- For calibration purpose ONLY, The PHY abstraction method described in slides 5-7 of R1-1610626 can be used for SLS of some MA schemes that use MMSE-SIC/PIC receiver.
  - Companies are encouraged to provide link level simulation results for different combinations of MCS and # of UEs for further verification

R1-1610686 WF on TR Structure for NR Multiple Access Nokia, ASB

Conclusion:
- Rapporteur to propose the detailed subsections for 8.1.3 based on agreements made and to be made in RAN1, e.g.:
  - Agreed observations, agreed PHY abstraction, etc.

R1-1610743 WF on UL grant-free workplan Huawei, HiSilicon, CMCC
R1-1610744 WF on non-orthogonal MA workplan Huawei, HiSilicon, CMCC
R1-1610745 WF on summary of UL non-orthogonal MA progress Huawei, HiSilicon

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Agreements:

- Capture the observations on page 4, and slides 7-10 into TR 38.802, with the following updates:
  - Non-orthogonal MA schemes using an advanced receiver ~~(e.g. SCMA, MUSA, IGMA)~~ have little or no performance loss due to MA signature (except RS) collision.
  - Some ~~N~~non-orthogonal MA results combined with narrowband and/or repetition operations can ~~potentially~~ reach
  - Non-orthogonal MA, in some of the evaluated scenarios, provides significant gain in terms of UL link-level sum throughput and overloading capability with ideal and realistic channel estimation ~~in the evaluated scenarios~~
  - Slides 9-10 are to be updated based on updated simulation results submitted to this meeting

R1-1610793 WF on SLS observations of non-orthogonal MA Huawei, HiSilicon, ZTE

Agreements:

- The observations on slide 3, along with appendix on slides 5 and 6, are agreed, with the following update:
  - All simulated non-orthogonal MA schemes with grant-free with advanced receivers (some with ideal channel estimation while others with realistic channel estimation) provide~~s~~ significant
  - compared to a respective grant-free reference scheme assumed ~~based on OFDMA with grant-free~~ by each company
  - Add a note to the appendix:
    - Note: the empty entries in the table are due to absence of simulation data
  - Add two rows in the tables in the Appendix listing the receive type(s) and HARQ combining used by each company
  - For the columns in the tables in the appendix with both ideal and realistic channel estimation, split each column into two columns capturing results with ideal and realistic channel estimation separately
  - slides 5-6 are to be updated based on updated simulation results submitted within this meeting

R1-1610746 WF on summary of grant-free progress Huawei, HiSilicon
R1-1610794 WF on UL grant-free technical aspects Huawei, HiSilicon
R1-1610818 WF on PHY abstraction method for MA SLS ZTE, ZTE Microelectronics, Huawei, HiSilicon

Agreements:

- The physical layer abstraction methods in *R1-168076* and slides 5-7 of R1-1610626 can be used for MA system-level evaluation with individual verification by each company
- The candidate PHY abstraction methods should be referred in TR 38.802 by using the two reference documents (R1-168076 and R1-1610626)

R1-1610957 WF on Further Summary of LLS Results Huawei, HiSilicon

Agreements:

- Further capture the LLS results in the tables on Page 4, 5, 6, and 7 of R1-1610957 into TR 38.802, with the following updates:
  - The results are to be updated based on updated simulation results submitted to this meeting
  - Note: the empty entries in the table are due to absence of simulation data
  - Change "SE" in the relevant places of the tables to "bits/RE"
    - Add a note whether or not CRC is included in determining "bits/RE" in each result of the corresponding tables
  - Add references to the MA schemes in the tables
- Also add receiver assumptions in the assumption table
- In addition, provide a reference to the spreadsheet capturing all LLS results
  - Note: CRC is excluded in coding rate determination
    - This is only a clarification, not to be captured in the TR

R1-1610826 WF on summary of grant-free progress Huawei, HiSilicon
Also supported by Convida wireless

R1-1610958 WF on Grant-free URRLC Performance Evaluations Huawei, HiSilicon

Friday
R1-1611065 To capture LLS and SLS simulation results for NR MA Huawei, HiSilicon

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- Email approval for capturing LLS and SLS simulation results for NR MA submitted to RAN1#86bis meeting until 21st October – Wang Yi (Huawei)
- Ccompanies are encouraged to provide input with the following to be captured into TR:
  - For LLS
    - MA signature setting [fixed/random]
    - To replace "overloading" by "number of supported UEs"
  - For SLS
    - BS antenna configuration
    - MA signature setting [fixed/random]
- The results in the attachment are a starting point.

Not treated.

R1-1608755	LLS results of PDMA with realistic channel estimation	CATT
R1-1608756	SLS results of PDMA	CATT
R1-1608757	Consideration on grant-free transmission	CATT
R1-1608758	Discussion on MA for URLLC	CATT
R1-1608803	Discussion on grant-free transmission for UL multiple access	Fujitsu
R1-1608852	Categorization and analysis of MA schemes	Huawei, HiSilicon
R1-1608853	Further UL LLS Results	Huawei, HiSilicon
R1-1608854	Further UL SLS Results	Huawei, HiSilicon
R1-1608855	Advanced multi-user detectors for grant-free transmissions	Huawei, HiSilicon
R1-1608858	Discussion on grant-free versus grant-based transmissions for infrequent small packets	Huawei, HiSilicon
R1-1608859	The retransmission and HARQ schemes for grant-free	Huawei, HiSilicon
R1-1608860	Solutions for collisions of MA signatures	Huawei, HiSilicon
R1-1608861	Resource allocation and management for grant-free UL	Huawei, HiSilicon
R1-1608917	Considerations on random resource selection	Spreadtrum Communications
R1-1608918	Multiple access schemes with considering different UE requirements	Spreadtrum Communications
R1-1608943	Interleaver based non-orthogonal multiple access	Sony
R1-1608952	System level performance evaluation for MUSA	ZTE
R1-1608953	Link level performance evaluation for MUSA	ZTE
R1-1608955	Considerations on the Preamble design for grant-free non-orthogonal MA	ZTE
R1-1609036	Discussion on low PAPR non-orthogonal multiple access	Samsung
R1-1609037	Discussion on grant-free based multiple access	Samsung
R1-1609038	Collision analysis of grant-free based multiple access	Samsung
R1-1609040	Basic channel structure for grant-free based multiple access	Samsung
R1-1609041	Link level evaluation results for IGMA	Samsung
R1-1609042	System level evaluation results for IGMA	Samsung
R1-1609223	Further evaluation results of NCMA in UL LLS	LG Electronics
R1-1609224	SLS evaluation results for the NR MA	LG Electronics
R1-1609225	Discussion on the MA evaluations and further considerations	LG Electronics
R1-1609226	Discussion on feedback signaling for grant-free MA	LG Electronics
R1-1609227	On MA resource and MA signature configurations	LG Electronics
R1-1609229	NoMA scheme based on NCMA	LG Electronics
R1-1609230	Discussion on Non-orthogonal Spreading Sequence and codebooks for NoMA	LG Electronics
R1-1609300	Discussion on multiple access schemes for URLLC	CMCC
R1-1609332	LLS results for GOCA schemes	MediaTek Inc.
R1-1609333	LLS results for RDMA schemes	MediaTek Inc.
R1-1609335	System level evaluation result on GOCA	MediaTek Inc.
R1-1609398	Uplink Grant-free Access for 5G mMTC	Lenovo
R1-1609399	Discussion on grant-free based UL transmission	Lenovo
R1-1609400	Discussion on retransmission design for grant-free based UL transmission	Lenovo
R1-1609441	Text Proposal of PHY abstraction method for NR MA	Huawei, HiSilicon
R1-1609442	Summary of email discussion thread 86-15 and 86-17 on SLS calibration for NR MA	Huawei, HiSilicon
R1-1609446	Reference signal design for UL grant-free transmission	Huawei, HiSilicon
R1-1609499	Grant-free UL transmissions in NR	Intel Corporation
R1-1609500	On spreading-based NOMA schemes	Intel Corporation
R1-1609501	DM-RS design and channel estimation for UL NOMA	Intel Corporation
R1-1609502	Retransmissions and repetitions for UL grant-free NOMA schemes	Intel Corporation
R1-1609548	DMRS design for non-orthogonal UL multiple access user channel estimation	ETRI
R1-1609553	Discussion on non-orthogonal MA for eMBB	CATT
R1-1609580	Discussion on non-orthogonal multiple access for URLLC usage scenario	CATR

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R1-1609612	Discussion on usage scenarios for non-orthogonal multiple access	MediaTek Inc.
R1-1609613	Benchmark with NB-IoT with non- orthogonal multiple access	MediaTek Inc.
R1-1609646	Summarizing the MA findings in the TR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609647	On MA resources for grant-free transmission	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609648	Collision handling for grant-free	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609649	Grant-free retransmission with diversity and combining for NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609650	Receiver considerations on UL MA	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609651	Non-orthogonal coded access (NOCA)	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609652	Calibration results for UL grant-free transmission	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609653	Preamble transmission procedures for the mMTC uplink	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609654	Link adaptation for grant-free transmissions	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609655	Relationship between grant-free and grant-based transmission	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609814	Multiple access schemes for NR phase 1	Panasonic Corporation
R1-1609873	Supporting URLLC in NR: Views and Recommendations	Sharp
R1-1609891	Interleaved-based MA in Fading and Asynchronous environments	InterDigital Communications
R1-1609892	On the Performance of Interleaved-based Multiple Access Schemes	InterDigital Communications
R1-1609893	Considerations on UL grant-free transmissions for mMTC	InterDigital Communications
R1-1610076	Discussion on multiple access for uplink eMBB	NTT DOCOMO, INC.
R1-1610077	SLS evaluation on uplink multiple access	NTT DOCOMO, INC.
R1-1610078	LLS evaluation on uplink multiple access	NTT DOCOMO, INC.
R1-1610118	Link level simulation results for RSMA vs OMA	Qualcomm Incorporated
R1-1610119	System level simulation results for calibration	Qualcomm Incorporated
R1-1610121	Battery life analysis for grant-free transmission	Qualcomm Incorporated
R1-1610122	Mixed grant-free and grant based multiple access	Qualcomm Incorporated
R1-1610214	On Synchronization Requirements for Grant-free MA	Ericsson
R1-1610298	System design considerations for UL NoMA	MediaTek Inc.
R1-1610374	Support of link adaptation for UL grant-free NOMA schemes	Intel Corporation
R1-1610375	Coverage performance for UL NOMA schemes	Intel Corporation
R1-1610376	Summary of current studies on NR Multiple Access	Intel Corporation
R1-1610478	Further LLS results for UL non-orthogonal multiple access	Fujitsu
R1-1610918	Link-level evaluation results of UL NOMA schemes	Intel Corporation
R1-1610965	WF on SLS/LLS results summary	LG Electronics
R1-1611008	System-level analysis of UL NOMA schemes	Intel Corporation
R1-1611023	Comparison of OFDMA vs LSSA system level UL performance	ETRI
R1-1611058	WF on further MA results summary	LG Electronics, Huawei, HiSilicon, ZTE, Samsung
R1-1611062	Summary of preliminary LLS results	Huawei, HiSilicon
R1-1611063	Summary of preliminary SLS results	Huawei, HiSilicon

8.1.2 Numerology and frame structure for new radio interface

R1-1611040 Offline outcome of Thursday afternoon on 8.1.2 NTT DOCOMO

Friday

R1-1611060 Offline outcome of Friday morning NTT DOCOMO

8.1.2.1 Numerology

R1-1610125 NR RB Size Design: 12 vs 16 Qualcomm Incorporated

The document was presented by Jing Jiang from Qualcomm.
Proposal: NR adopts 16 REs per PRB for both UL and DL at least for sub-6 eMBB.
Decision: The document is noted.

R1-1608963 About RB grid definition and handling inter-numerology interference in NR ZTE

The document was presented by Thorsten Schier from ZTE.

- Observation 1: The RB grid shall be the same for FDM and TDM
- Observation 2: A nested RB grid structure for FDM ensures RB alignment among different eNBs
- Observation 3: The alternative option to use the RB grid derived from the 15 kHz SCS even for numerologies with wider RBs can lead to RB-misalignment across multiple cells.
- Observation 4: Also for FDM, the nested RB grid does not waste resources
- Proposal 1: Adopt RB grid for FDM as it is agreed in TDM
- Proposal 2: Two methods to handle inter-numerology interference between two adjacent numerologies may be considered. We prefer the first one.
    - A configurable guard band with a granularity in sub-carries. This is especially beneficial when different numerology are multiplexed in a dynamic manner

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- In scenarios of lower load or when numerologies are multiplexed semi-statically, a guard band may not be needed. The two numerologies could be placed directly adjacently to each other and different schemes to lower the MCS may be employed.

- Proposal 3: GB configuration mechanisms should be considered, a)semi-static; b)dynamic; c)scheduling; or some combination of above approaches.
- Proposal 4: RAN1 should study the impact of introducing a guard band on the signal design and corresponding techniques to handle it.

Decision: The document is noted.

R1-1610055 Wider BW operation for NR NTT DOCOMO, INC.

The document was presented by Kazuaki Takeda from NTT DOCOMO.

- Proposal: Study an efficient mechanism to achieve a wider BW of around 1GHz and the corresponding feasibilities from both NW and UE perspectives.
- Observation: It would be desired that UE with different BW capability can have flexibility to access to the NR carriers regardless of NW channel BW and the number of NR carriers.

Discussion: Ericsson→Maximum supportable BW is a RAN4 issue and their feedback is needed.

Decision: The document is noted.

R1-1610124 60kHz vs. 120kHz vs. 240kHz performance; impact to PN Qualcomm Incorporated

The document was presented by … from Qualcomm.

- Observation 1: From most artifacts of the millimeter wave link, two are directly affected by tone spacing, if the CP overhead is kept constant. These are the phase noise and intersymbol interference caused by channel delay spread exceeding the CP length.
- Observation 2: Increasing the tonespacing from 60kHz to 120kHz causes a noticeable improvement in many cases and in the worst catgory the performance remains the same.
- Observation3: Increasing the tone spacing to 240kHz is only advantageous for the "normal delay" category and a further increase to 480kHz reduce performance for all categories.
- Proposal 1: Prioritize a tone spacing of 120 kHz for millimeter wave airlinks.

Decision: The document is noted.

R1-1609050 Numerology for URLLC Samsung

The document was presented by Youngbum Kim from Samsung.

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- **Error! Reference source not found.**

Decision: The document is noted.

R1-1609048 Time Alignment Among Different Numerologies for Same CP Overhead Samsung

The document was presented by Youngbum Kim from Samsung.

Proposal: RAN1 should consider the proposed alternatives (summarized in Table 1) for supporting time alignment among different numerologies with same CP overhead.

Decision: The document is noted.

R1-1609232 Details on symbol-level alignmentLG Electronics

The document was presented by Yunjung Yi from LGE.

Proposal 1: There are two cases: inband and outband multiplexing different numerologies defined. If symbol level alignment is considered, it is restricted to inband cases.
Proposal 2: For NCP family, adopt Option 3 for symbol level alignment.

- *Option 3: Reserve 0.51us, and utilize the same CP for all OFDM symbols*

Decision: The document is noted.

R1-1609427 Evaluation and discussion on CP types for above 6GHz Huawei, HiSilicon

The document was presented by … from Huawei.

Proposal 1: NR should support ECP for 120kHz below 40GHz band.
Proposal 2: NR should support ECP for 960kHz above 40GHz band.

Decision: The document is noted.

R1-1609894 System level evaluations for multiple CP lengths InterDigital Communications

The document was presented by Shahrokh Nayeb Nazar from InterDigital.

Proposal: NR design should support Zero-CP length for a given subcarrier spacing.

Decision: The document is noted.

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R1-1610300 CP length for NR VODAFONE Group Plc

The document was presented by Razieh Razavi from Vodafone.

- Observation 1: The most optimal cyclic prefix to set for the radio interface may depend very much on the specific environment of the UE. Being able to adapt the CP to suit the actual delay spread observed, this could help the link performance, and improve the end user experience.
- Observation 2: Several values of CP per numerology, i.e., Reduced CP, Normal CP and Extended CP, may help to optimize the CP overhead with respect to the UE experienced delay spread and service.
- It is proposed that:
- Proposal 1: NR should support ECP for eMBB and low latency usecases. The representative value of the delay spread related to the aforementioned scenarios should be investigated in order to select the appropriate ECP values per numerology in phase 1.
- Proposal 2: Multiple CP lengths per numerology should be defined for eMBB and URLLC use cases to support different scenarios and delay spread in phase 1 (and later phases).
- Proposal 3: More than one CP lengths can be operated within a cell in both uplink and downlink for eMBB and URLLC use cases in phase 1 (and later phases).

Decision: The document is noted.

R1-1609313 Numerologies for different carrier frequencies KT Corp.

The document was presented by … from KT and provides a study on subcarrier spacing values that are required for each use case in target frequency bands.

Decision: The document is noted.

R1-1610488 Way Forward on wider BW operation for NR NTT DOCOMO, AT&T

The document was presented by Kazuaki Takeda from NTT DOCOMO.

- Study the following mechanisms from RAN1 perspective to support the wider bandwidth of around 1GHz and the corresponding feasibilities from both NW and UE perspectives
  - Carrier Aggregation/Dual Connectivity (Multi-carrier approach)
    - Details are FFS
  - Single carrier operation
    - Details are FFS
    - Maximum channel BW continues to be studied in RAN1/4
- Send an LS to ask RAN4 to take into account the above proposals

Decision: The document is noted, modified and agreed as follows:

Agreements

- At least for Phase 1, study mechanisms to support operation over e.g. around 1GHz contiguous spectrum from both NW and UE perspectives including the maximum single carrier bandwidth of at least 80 MHz
  - Carrier Aggregation/Dual Connectivity (Multi-carrier approach)
    - Details are FFS
    - FFS: non-contiguous spectrum case
  - Single carrier operation
    - Details are FFS
    - Maximum channel bandwidth continues to be studied in RAN1/4
      - Maximum bandwidth supported by some UE capabilities/categories may be less than channel bandwidth of serving single carrier
        - Note that some UE capabilities/categories may support channel bandwidth of serving single carrier
- Send an LS to ask RAN4 to study the feasibility of the above mechanisms from both NW and UE perspectives

Prepare draft LS to RAN4 until Tuesday morning – Kazuaki (DOCOMO)

Tuesday:

R1-1610508 [Draft] LS on wider bandwidth operation for NR NTT DOCOMO

Decision: The document is noted and final LS is approved in R1-1610655, with following update:

RAN1 ~~had discussion~~discussed ~~regarding~~ how to support operation over, e.g., around 1 GHz contiguous spectrum and reached the following agreements.

R1-1610503 Way Forward on Alignments among different numerologies in frequency domain LG Electronics

The document was presented by Yunjung Yi from LGE.

- For a given numerology/subcarrier spacing, a UE is indicated implicitly and/or explicitly on the start and end frequency
  - Start and end frequency location can be aligned with RB boundary based on reference numerology
- A UE forms RB for the given numerology from the starting frequency location per each numerology/subcarrier spacing

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- Note: Depending on the start/end frequency configuration, RB grid of different numerologies can be formed in a nested manner or RB grid can be formed to maximize resource utilization

Decision: The document is noted. Continue discussion – (LGE)

- The number of subcarriers per PRB is:
  - Alt.1: 12 supported by CATT, Huawei, HiSilicon, Nokia, InterDigital, ETRI, Intel, Ericsson, Panasonic
  - Alt.2: 16 supported by Qualcomm (can agree on Alt 1 but would like to clarify that common understanding is that there are performance issue for small packet size).

Agreement: The number of subcarriers per PRB is 12.

- Adopt RB grid for FDM as it was agreed in TDM (ZTE: similar proposal in R1-1610483) – supported by ZTE, ZTE Microelectronics, Ericsson, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic, Convida Wireless, Intel, CATT, InterDigital, Samsung, MediaTek, ETRI
- NR carrier shall support UEs with bandwidth support smaller than the carrier bandwidth
- FFS: Fractional RB support

R1-1610483 Way Forward on RB grid definition for mixed numerologies - FDM ZTE, ZTE Microelectronics, Ericsson, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic, Convida Wireless

Decision: The document is noted.

Working assumption: Adopt RB grid for FDM as it was agreed in TDM

Possible Working assumption:

- In the DL transmission to a UE, the subcarrier overlapping with the DC subcarrier of the receiving UE is modulated in the same way as other subcarriers of the same PRB
  - UE may puncture the DC subcarrier

Continue offline discussion within Monday – (Ericsson)

Possible working assumption (Monday evening):

- For transmitter side, in a DL transmission to a UE, the subcarrier overlapping with the DC subcarrier of the receiving UE is modulated in the same way as other subcarriers of the same PRB
- For receiver side, UE may puncture the DC subcarrier
- DC handling in the receiver side will not be specified

Continue offline discussion until Tuesday – Stefan (Ericsson)

Tuesday

R1-1610622 Way Forward on DC subcarrier Ericsson

- Transmitter side
  - No special handling of the DC subcarrier(s) (if present) on the transmitter side is specified in RAN1
    - Consequence of previous agreement "*No explicit DC subcarrier is reserved both for DL and UL*"
- Receiver side
  - No special handling of the DC subcarrier(s) (if present) on the receiver side is specified in RAN1
    - Behavior left to implementation, the receiver may for example puncture data received on the DC subcarrier

Decision: The document is noted.

Possible working assumption:

- Transmitter side
  - No special handling of the DC subcarrier(s) on the transmitter side is specified in RAN1

Continue offline discussion until Wednesday – Stefan (Ericsson)

Agreements:

- Receiver side
  - No special handling of the DC subcarrier(s) on the receiver side is specified in RAN1
    - Behavior left to implementation, the receiver may for example puncture data received on the DC subcarrier

Wednesday: Qualcomm' comment→ was not present when above agreement has been made, is ok to keep the agreement but would like to understand what transmitter/receiver sides mean? DC subcarriers (if present or not) imply 4 cases being considered.

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Agreements:

- Regarding DC present within the transmitter,
  - DC Handling of DC subcarrier in transmitter side is specified
    - Receiver knows where DC subcarrier is or is informed (e.g., by specification or signaling) of where DC subcarrier is or if DC subcarrier is not present within receiver bandwidth
    - When receiver is informed DC subcarrier is present, FFS: transmitter DC subcarrier is punctured, rate matched, modulated, or EVM is not specified
    - When DC subcarrier is not present, all subcarriers within the receiver bandwidth are transmitted

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R1-1610521 Way Forward on Subframe duration ZTE, ZTE Microelectronics, Ericsson, NTT Docomo, Nokia, Qualcomm, Panasonic, CATT, Mediatek, Convida Wireless
Decision: The document is noted.

Agreements:

- Sub-frame duration is fixed to 1ms
- Reference numerology for defining subframe duration is 15 kHz

R1-1610540 Way Forward on slot NTT DOCOMO, INC., Ericsson, Panasonic, Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm, Huawei, HiSilicon
Decision: The document is noted.

Agreements:

- For SCS of up to 60kHz with NCP, y = 7 and 14
  - FFS: whether/which to down select for certain SCS(s)
- For SCS of higher than 60kHz with NCP, y = 14

R1-1610500 Way Forward on Numerology for forward compatibility InterDigital, Mitsubishi, Nokia, Alcatel-Lucent Shanghai Bell, Intel

- Numerology and frame structure decisions in NR should consider zero-length CP overhead for above 40 GHz

Decision: The document is noted. Also supported by KDDI. Continue discussion

Agreement: RAN1 has not so far identified any forward compatibility issues for the potential introduction of new waveforms including zero-length CP in the future.

Tuesday
R1-1610652 Way Forward on Symbol Level Alignments LG Electronics, NTT DOCOMO, Ericsson, Panasonic, Qualcomm, ZTE (R1-1610502)

- Confirm WA in the background
- For normal CP family, the following is adopted
  - For F_s = 15 kHz * 2^n (n is a positive integer),
    - Each symbol length (including CP) of 15 kHz equals the sum of the corresponding 2^n symbols of F_s
    - Other than the first OS in every 0.5msec, all OFDM symbols within 0.5msec have the same size
    - The first OS in 0.5msec has longer CP of 16 Ts (assuming 15 kHz and FFT size of 2048) compared to other OSs
  - For F_s = 15 kHz * 2^n (n is a negative integer)
    - Each symbol length (including CP) of F_s equals the sum of the corresponding 2^n symbols of 15 kHz

Decision: The document is noted.

Agreement:

- Alignment within a subframe
  - Symbol level alignment across different subcarrier spacings with the same CP overhead is assumed within a subframe duration in a NR carrier
  - FFS: Unlicensed spectrum case

(Agreement):

- For normal CP family, the following is adopted
  - For F_s = 15 kHz * 2^n (n is non-negative integer),
    - Each symbol length (including CP) of 15 kHz equals the sum of the corresponding 2^n symbols of F_s
    - Other than the first OS in every 0.5msec, all OFDM symbols within 0.5msec have the same size

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        - FFS: The first OS in 0.5msec has longer CP of 16 Ts (assuming 15 kHz and FFT size of 2048) compared to other OSs
    - FFS: For F_s = 15 kHz * 2^n (n is a negative integer)
        - Each symbol length (including CP) of F_s equals the sum of the corresponding 2^{-n} symbols of 15 kHz

Discuss further on above FFS
Wednesday: Above agreement is modified as follows:
Agreement:

- For normal CP family, the following is adopted
    - For F_s = 15 kHz * 2^n (n is non-negative integer),
        - Each symbol length (including CP) of 15 kHz equals the sum of the corresponding 2^n symbols of F_s
        - Other than the first OS in every 0.5msec, all OFDM symbols within 0.5msec have the same size
        - The first OS in 0.5msec is longer by 16 Ts (assuming 15 kHz and FFT size of 2048) compared to other OSs
            - FFS: How to utilize this 16 Ts
    - For F_s = 15 kHz * 2^n (n is a negative integer)
        - Each symbol length (including CP and 16 Ts) of F_s equals the sum of the corresponding 2^{-n} symbols of 15 kHz

Thursday: Above FFS is replaced by:

- 16 Ts is used for CP for the first symbol

Thursday session

R1-1610126 Scaled CP vs ECP: delay spread, Doppler and SNR tradeoff study Qualcomm Incorporated

- Proposal 1: Design of an additional scaled numerology family with ECP (large CP overhead) should happen only if strong use cases or deployments scenarios are identified, where the normal CP scaled numerology family cannot provide an acceptable performance.
- Proposal 2: The NCP scalable numerology family can be adapted for different delay and Doppler scenarios dynamically or semi-statically.
- Proposal 3: Evaluation of different CP families should happen in conjunction with pilot pattern design.

Decision: The document is noted.

R1-1610142 URLLC Channel Coding Qualcomm

R1-1610810 Way forward on CP Huawei, HiSilicon, Sony, OPPO, CATT, Vodafone, Ericsson, ZTE, Intel , Mediatek, NTT DOCOMO, CATR

Agreements:

- From Phase 1, physical layer design should support an extended CP
    - Extended CP will be only one in given subcarrier spacing
- FFS: Exact for the services/scenarios for extended CP

R1-1610791 WF on Fractional RB usage Samsung, ZTE, ZTE Microelectronics, Panasonic, KDDI, IITH, IITM, Tejas Networks, CEWiT, Nokia
Also supported by ASB, Reliance jio
Continue discussions

R1-1610949 WF on forward compatibility for NR Samsung, LG Electronics, Nokia, ASB, Ericsson, Huawei, HiSilicon, Qualcomm, AT&T, Panasonic

Agreements:

- Explicit signaling to NR UEs can indicate reserved resources
    - The details on signaling information and transmission are FFS
        - e.g. granularity for blank resource indication
        - e.g. RRC signaling and/or L1 signaling (including DL control information)
        - e.g. broadcast and/or unicast signaling
        - e.g., whether this signaling is applicable to UE UL operation and/or DL operation and/or sidelink operation
        - FFS: combination of above signaling
        - FFS: time and frequency granularity

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R1-1610953 WF on carrier aggregation Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO, Qualcomm, ZTE

Agreements:

- Study at least the following aspects for NR carrier aggregation / dual connectivity
  - Intra-TRP and inter-TRP with ideal and non-ideal backhaul scenarios
  - Number of carriers
  - The need for certain channels, e.g. downlink control channel, uplink control channel or PBCH for some carriers
  - Cross-carrier scheduling and joint UCI feedback, e.g. HARQ-ACK feedback
  - TB mapping, i.e., per carrier or across carriers
  - Carrier on/off switching mechanism
  - Power control
  - Different numerologies between different/same carrier(s) for a given UE
    - FFS: whether/if different numerologies are multiplexed on one carrier for one UE is called carrier aggregation / dual connectivity

Not treated.

R1-1608759 NR numerology CATT
R1-1608760 NR CP length for different numerologies CATT
R1-1608761 NR symbol alignment and operation in unlicensed spectrum CATT
R1-1608833 Discussion on time alignment with different CP overhead Huawei, HiSilicon
R1-1608834 Discussion on time alignment with the same CP overhead Huawei, HiSilicon
R1-1608835 Evaluation on CP types for 60kHz subcarrierHuawei, HiSilicon
R1-1608844 Support of URLLC in DL Huawei, HiSilicon
R1-1608900 Subcarrier spacing design for data and reference signal Guangdong OPPO Mobile Telecom.
R1-1608901 Discussion of the UE support of multiple numerologies Guangdong OPPO Mobile Telecom.
R1-1608920 Discussion on numerology of NR Spreadtrum Communications
R1-1608945 Discussion on longer CP lengths Sony
R1-1608961 Reference numerology for NR ZTE
R1-1608962 About the support of multiple CP families for NR ZTE
R1-1609044 Discussion on guard-band supporting methods Samsung
R1-1609045 RB grid for mixed numerology Samsung
R1-1609046 Number of subcarriers per PRB Samsung
R1-1609047 Support of Different Numerologies for Same Vertical Samsung
R1-1609049 Time Alignment Among Different Numerologies for Different CP Overhead Samsung
R1-1609051 Consideration on UE capability to process multiple numerologies Samsung
R1-1609153 Discussion on PSS/SSS/PBCH in numerology multiplexing NEC
R1-1609159 On Number of subcarriers per PRB for NR NEC
R1-1609231 Discussion on 60kHz CP options LG Electronics
R1-1609233 Discussion on time-alignment between different CP families LG Electronics
R1-1609301 Discussion on phase noise modeling CMCC
R1-1609302 Discussion on High Mobility Numerology and RS design CMCC
R1-1609303 Discussion and evaluation of CP design for NR CMCC
R1-1609425 Discussion on UE behavior on mixed numerology carrier Huawei, HiSilicon
R1-1609426 Evaluation on subcarrier spacing and CP types for UL transmission Huawei, HiSilicon
R1-1609428 Numerology for 70 GHz and above Huawei, HiSilicon
R1-1609430 On multiple carrier operation Huawei, HiSilicon
R1-1609503 Reference numerology and time alignment Intel Corporation
R1-1609504 Slot and mini-slot numerology and alignment Intel Corporation
R1-1609505 Capability to support multiple numerologies Intel Corporation
R1-1609608 Discussion on the subcarrier spacing selection for NRETRI
R1-1609625 On RB structure for mixed numerologies Ericsson
R1-1609626 On RB size Ericsson
R1-1609627 On supported numerologies Ericsson
R1-1609635 On symbol alignment Ericsson
R1-1609642 On extended CP Ericsson
R1-1609645 On half-subcarrier shift in NR UL Ericsson
R1-1609656 On the symbol level alignment across different subcarrier spacings Nokia, Alcatel-Lucent Shanghai Bell
R1-1609657 On the number of subcarriers per PRB Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-1609658 Supported numerologies for NR Phase I Nokia, Alcatel-Lucent Shanghai Bell
R1-1609659 Guard band arrangement supporting mixed numerology Nokia, Alcatel-Lucent Shanghai Bell

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R1-1609660 Intra-carrier sub-band for mixed numerologyNokia, Alcatel-Lucent Shanghai Bell
R1-1609661 Comparison of ECP and NCP link performance with 60 kHz subcarrier spacing Nokia, Alcatel-Lucent Shanghai Bell
R1-1609698 Remaining numerology related aspects Panasonic Corporation
R1-1609791 Proposals for frame format supporting different CP families Mitsubishi Electric
R1-1610022 UE support for multiple numerologies for NR INTERDIGITAL COMMUNICATIONS
R1-1610080 Remaining numerology aspects NTT DOCOMO, INC.
R1-1610123 URLLC numerology and frame structure design Qualcomm Incorporated
R1-1610127 Numerology tradeoff case study Qualcomm Incorporated
R1-1610297 Evaluation of UW DFT-s-OFDM as a CPless waveform for high speed train scenario Mitsubishi Electric Co.
R1-1610426 Numerology design and link-level simulation results for high speed scenario ETRI

8.1.2.2 Frame structure

Summarize the frame structure study
Note that detailed signal/channel design can be studied in other sub-agendas

R1-1610129 Summary of [86-19] Discussion on Slot Structure Use Cases Qualcomm Incorporated
The document was presented by Joseph Soriaga from Qualcomm.

Proposal 1: *For the slot duration y, at least the following should be supported*
- *Configurations supporting slot y= 7 and 14 symbols*

Proposal 2: *For transmission durations of EMBB, at least the following should be supported*
- *Ability to define transmission duration through the aggregation of slots*
  - *Configuration may be through semi-static RRC signaling or dynamic L1 indication*
  - *FFS: if any aspects of aggregation or related control should be captured in specification*
- *Ability to configure the minimum transmission duration of more than 14 symbols at higher SCS*
  - *FFS: how to define the minimum*
    - *Option 1. Minimum value of SCS (e.g., 120kHz needs 28 symbols)*
    - *Option 2. Minimum transmission duration of [0.125ms]*
  - *Option 1: Configuration of y to be larger than 14*
  - *Option 2: Aggregation of slots to achieve*

Proposal 3: *The NR frame structure should support both slots and mini-slots.*
- *FFS: Timeline granularity for monitoring control of the mini-slot*

Proposal 4: *The NR frame structure should at least support the following*
- *Periodicities for downlink and uplink control equal to 250us, 500us, and 1m*
- *Longer intervals or aperiodicity resulting from e.g., semistatic or dynamic slot aggregation*

Proposal 5: *Define a subframe duration as 1 ms with a reference numerology 14-symbols at 15 kHz SCS.*

Decision: The document is noted.

Working assumption~~Possible agreements~~:
- The NR frame structure should support both slots and mini-slots
  - FFS: Timeline granularity for monitoring control of the mini-slot
  - FFS: Terminologies of mini-slot

Continue discussion.
Tuesday: Huawei → no progress on mini-slots structure so far, cannot get it agreed – working assumption can be a step forward

Tuesday
Possible agreements:
- Multiple slots can be aggregated in NR
  - Aggregation may be through semi-static RRC signaling and/or dynamic L1 indication and/or pre-determined by specification
  - Multiple-slot aggregation is supported at least for the following use cases in NR
  - One DL/UL assignment over one or multiple slots in the aggregated slots

Agreements:
- Slot aggregation is supported
- Data transmission can be scheduled to span one or multiple slots

Possible agreements:
- For slot based transmission, the NR frame structure should at least support the following

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- Periodicities for possible downlink and uplink control transmission equal to or approximately 125us, 250us, 500us, and 1ms
- Longer intervals or aperiodicity resulting from e.g., semistatic or dynamic slot aggregation

Continue offline discussion until Wednesday

R1-1609630 On UE-specific DC subcarrier in NR Ericsson

Observation: Ignoring the information transmitted on the DC subcarrier slightly increases the effective code rate. The code rate increase is worst for a single PRB allocation and gets smaller for wider allocation.
Proposal: In a DL transmission to a UE, the subcarrier overlapping with the DC subcarrier of the receiving UE is modulated in the same way as other subcarriers of the same PRB.

Decision: The document is noted.

R1-1609510 Discussion on mini-slot structure for URLLC Intel Corporation

The document was presented by … from Intel.

Proposal 1

- *A set of URLLC transmission durations (mini-slots) is configured to a UE.*
- *The sets of URLLC transmission durations for DL and for UL may be independently configured.*
- *Flexible URLLC transmission durations are realized by aggregation of mini-slots.*

Proposal 2

- *URLLC resource access granularity is equal to or shorter than the minimum configured URLLC TTI duration.*
  - *FFS the performance benefits vs complexity tradeoffs for symbol level resource access granularity for URLLC services.*

Decision: The document is noted.

R1-1608710 Frame Structure for Ultra-Low Latency Scheduled-based UL Access Idaho National Laboratory

The document was presented by Ramon Khalona from INL.

- Observation: To enable a schedule-based UL access with dynamic eMBB/URLCC multiplexing in dynamic TDD deployments requires an ultra-fast scheduling-request signal.
- Observation: Zero-wait-time scheduling request transmitted as an underlay signal reduces the average wait time to almost zero, eliminates the delay uncertainty and provides scheduling flexibility to the eNB to adapt and dynamically allocate resources for UL transmissions meeting the most stringent URLLC latency requirements.
- Observation: Underlay SR signals transmissions have the same numerology as the data channel.
- Proposal: NR should support shorter SR transmissions lasting n symbols located at those regions indicated in Figure 3, where $0 < n < (N - N_{DCI} - N_{UCI} - N_{GP})$ and N, N_{DCI}, N_{UCI}, and N_{GP} are the maximum number of symbols, number of DCI symbols, number of UCI symbols and the switching-gap duration in a subframe, respectively.

Decision: The document is noted.

R1-1608903 Discussion of the UE processing time on the support of multiple numerologies and frame structures Guangdong OPPO Mobile Telecom.

The document was presented by … from OPPO.

- Proposal 1: NR should not assume fixed UE processing time
- Proposal 2: UE processing time is divided into different level/class and UE reports its supported level/class.

Decision: The document is noted.

R1-1609145 Discussion on numerology multiplexing for supporting different service requirements NEC

The document was presented by Rajitha Palipana from NEC.

- Proposal 1: Support configuration of a waveform of a selected numerology that is optimum for one selected service applied for the entire carrier BW and last for a period of time.
- Proposal 2: Support configuration of multiple waveforms of different numerologies frequency multiplexed within the carrier BW to simultaneously and optimally serve different services.
- Proposal 3: Not to support dynamic configuration of multiple numerologies to support fast change of waveform to adapt to instantaneous demand.
- Observation 1: It is observed that UE-specific numerology handling on subframe basis may need further study on resource block and subframe design strategies for seamless co-existence of UEs having different numerologies.

Decision: The document is noted.

R1-1608942 Multiplexing eMBB and URLLC Transmissions Sony

The document was presented by Martin Beale from Sony.

- Observation 1: TDM does not efficiently utilises the resources in multiplexing eMBB and URLLC.
- Observation 2: It may not be beneficial to FDM eMBB and URLLC.

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- Observation 3: It is beneficial that the UE receiving eMBB transmission is aware that this transmission is corrupted by an overlapping URLLC transmission.
- Proposal 1: Introduce a downlink control channel at the end of an eMBB transmission frame structure to provide repair information on any overlapping URLLC transmission.

Decision: The document is noted.

R1-1609609 Discussion on time domain frame structure for high speed train scenario with relay for NR ETRI

The document was presented by … from ETRI.

- Observation 1: The probability of Random Access (RA) collision is very low in HST scenario with relay, and in most of the cases there is only one active relay sending network access request.
- Observation 2: Because the RA collision in HST scenario with relay is not severe and it can be avoided simply, preamble and TA related transmission/reception and processing are no more necessary.
- Proposal 1: The advanced frame structure, which is applicable for the fixed DL transmission and dynamic UL reception in time domain, should be supported at least for the HST scenario with relay for NR.
- Proposal 2: The methods for finding the boundary of UL part during reception by BBU (BS) is FFS.

Decision: The document is noted.

R1-1609919 Flexible frame structure and control signalling for NR Motorola Mobility

The document was presented by … from MotM and proposes:

- slots and mini-slots
  - Slot duration is y=7 OFDM symbols in the numerology used for transmission.
  - UE can be configured with a mini-slot.
    - mini-slot duration is y'=1 OFDM symbol in the numerology used for transmission.
    - It is preferable to support only 1 OFDM symbol mini-slot length. However, if multiple mini-slot lengths are defined, the UE can be configured with only one mini-slot length at any given time.
    - mini-slot configuration should be supported at least for subcarrier spacing ≤ 30kHz
- DL control signalling
  - DL control signalling can be sent to the UE once every slot duration
  - If the UE is configured with a mini-slot, DL control signalling can be sent to the UE once every mini-slot
    - If start of every slot does not align with a mini-slot (e.g. for 2 symbol mini-slot) DL control signalling can be sent to the UE once every mini-slot and once every slot.
- Resource allocation granularity
  - UE can be assigned DL/UL resources in multiples of Time resource units (TRUs).
    - 1TRU corresponds to all available OFDM symbols within one slot
  - UE can also be configured to receive mini-TRU based DL/UL resource assignments.
    - 1 mini-TRU corresponds to one OFDM symbol in the numerology used for transmission

Decision: The document is noted.

R1-1610546 Way Forward on bandwidth adaptation in NR MediaTek, Acer, CHTTL, III, Panasonic, Ericsson, AT&T, Nokia, ASB, Qualcomm
R1-1611041 Way Forward on bandwidth adaptation in NR MediaTek, Acer, CHTTL, III, Panasonic, Ericsson, Nokia, ASB, Samsung, LG, Intel

Agreements:

- At least for single carrier operation, NR should allow a UE to operate in a way where it receives at least downlink control information in a first RF bandwidth and where the UE is not expected to receive in a second RF bandwidth that is larger than the first RF bandwidth within less than X μs (FFS: value of X)
  - FFS the first RF bandwidth is within the second RF bandwidth
    - FFS the first RF bandwidth is at the center of the second RF bandwidth
  - FFS the maximal ratio of the first RF bandwidth over the second RF bandwidth
  - FFS detailed mechanism
- FFS RF bandwidth adaptation for RRM measurement

R1-1610902 WF on Multiplexing eMBB and URLLC in DL Samsung, Panasonic, ZTE, ZTE Microelectronics, ETRI, Ericsson, CATT, Huawei, NTT DOCOMO, LGE, CMCC, Convida wireless, InterDigital, Sony, Fujitsu

Also supported by Sharp, HiSilicon

Agreements:

- From network perspective, multiplexing of transmissions with different latency and/or reliability requirements for eMBB/URLLC in DL is supported by
  - Using the same sub-carrier spacing with the same CP overhead
    - FFS: different CP overhead

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- Using different sub-carrier spacing
  - FFS: CP overhead
- NR supports both approaches by specification

- NR should support dynamic resource sharing between different latency and/or reliability requirements for eMBB/URLLC in DL
  ~~FFS: Especially for the case where the NW operates with multiple different scheduling intervals~~

R1-1610995 WF on dynamic resource sharing between eMBB and URLLC in DL Huawei, HiSilicon, CATR, Potevio, Samsung
R1-1610952 Semi-static resource sharing between eMBB and URLLC LG Electronics, Panasonic

Agreements:

- Consider further the tradeoffs for meeting URLLC requirements for the following.
  - Semi-static resource allocation for UL data transmission.
  - Dynamic indication of available resource (e.g., by broadcast DCI) for UL data transmission.
  - Normal SR-based transmission
  - Other solutions are not precluded

Not treated.

R1-1608762 Way Forward on UE-specific slot configuration CATT
R1-1608763 NR Time domain structure: subframe, slot and mini-slot and time interval CATT
R1-1608764 NR frame structure for multiplexing of URLLC and eMBB traffic CATT
R1-1608765 NR frequency domain structure: PRB CATT
R1-1608766 Configurable DL control channel monitoring in NR system design CATT
R1-1608767 On-demand access for UE power saving in NR system design CATT
R1-1608804 NR Frame structure considerations for low latency TDD operation Fujitsu
R1-1608805 Discussion on flexible/dynamic TDD Fujitsu
R1-1608806 Guard period setting in TDD based NR frame structure Fujitsu
R1-1608807 TDD frame structure with mixed numerology Fujitsu
R1-1608808 Discussion on subframe design with symbol level alignment Fujitsu
R1-1608836 Discussion on time domain structures Huawei, HiSilicon
R1-1608837 Discussion on slot and mini-slot Huawei, HiSilicon
R1-1608841 Support of flexible bandwidth Huawei, HiSilicon
R1-1608842 Discussion on blank resources Huawei, HiSilicon
R1-1608902 Discussion on subframe structure for NR Guangdong OPPO Mobile Telecom.
R1-1608904 Effects of channel reciprocity-based MIMO on frame structure design Guangdong OPPO Mobile Telecom.
R1-1608957 Multiplexing of eMBB and URLLC ZTE
R1-1608964 About slot structure and scheduling units for NR ZTE
R1-1609053 Time domain structure design Samsung
R1-1609054 FDM for eMBB and URLLC Samsung
R1-1609055 Forward compatibility considerations for joint operation of wireless backhaul and access Samsung
R1-1609057 Evaluation results of eMBB with HARQ retransmission in case of multiplexing eMBB and URLLC Samsung
R1-1609058 Evaluation results of superposition scheme in case of multiplexing eMBB and URLLC Samsung
R1-1609059 Multiplexing URLLC and eMBB in DL Samsung
R1-1609060 Impact on eMBB PDSCH BLER by eMBB puncturing to support URLLC Samsung
R1-1609061 User plane latency evaluation results for URLLC in FDD NR Samsung
R1-1609062 User plane latency evaluation results for URLLC in TDD NR Samsung
R1-1609151 Proposals for frame structure NEC
R1-1609234 Discussion on frequency-alignment and resource block structure for different numerologies LG Electronics
R1-1609235 Discussion on subframe/slot/mini-slot LG Electronics
R1-1609236 On multiplexing between eMBB and URLLC LG Electronics
R1-1609238 Discussion on multi-carrier operation between LTE and NR LG Electronics
R1-1609386 NR Frame Structure Design Requirements AT&T GNS Belgium SPRL
R1-1609391 Frequency domain NR frame structure ETRI
R1-1609392 Multiplexing of eMBB and URLLC transmissions ETRI
R1-1609393 Discussion on the slot structure in time domain ETRI
R1-1609433 Discussion on DC handling for downlink and uplink Huawei, HiSilicon
R1-1609506 NR physical resource block definition Intel Corporation

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R1-1609507 Further details on NR slotsIntel Corporation
R1-1609508 Frame Structure for NR unlicensed operation Intel Corporation
R1-1609509 NR frame structure for forward compatibility Intel Corporation
R1-1609550 On the PRB definition: subcarrier number analysis MediaTek Inc.
R1-1609554 Views on remaining issues for NR frame structure MediaTek Inc.
R1-1609555 Discussion on slot strucutre and channel format MediaTek Inc.
R1-1609556 Cross slot scheduling in NR MediaTek Inc.
R1-1609618 On slots and mini-slots Ericsson
R1-1609621 On carrier bandwidth Ericsson
R1-1609629 On subframes Ericsson
R1-1609662 On the subframe and slot strcutures in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1609663 On the mini-slot structures in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1609664 Comparison of slot and mini-slot based approaches for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1609665 On bandwidth extension solutions in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1609666 On the indication of forward compatibility resources Nokia, Alcatel-Lucent Shanghai Bell
R1-1609667 On the unlicensed band operation in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1609700 Remaining frame structure discussion Panasonic Corporation
R1-1609800 On unified NR frame structure for different spectrum types ZTE
R1-1609815 Discussion on frequency domain frame structure for NR Panasonic Corporation
R1-1609874 Supporting URLLC in NR: Views and Recommendations Sharp
R1-1609886 Discussion on flexible slot structure with different numerologies Potevio
R1-1610023 Frame structure for NR INTERDIGITAL COMMUNICATIONS
R1-1610024 On the number of subcarriers per PRB for NR INTERDIGITAL COMMUNICATIONS
R1-1610051 On PRB alignment for different NR numerologies INTERDIGITAL COMMUNICATIONS
R1-1610061 Frequency-domain aspects of frame structure NTT DOCOMO, INC.
R1-1610081 Time-domain aspects of frame structure NTT DOCOMO, INC.
R1-1610088 On time alignment between numerologies of different CP overhead INTERDIGITAL COMMUNICATIONS
R1-1610130 Scalable Numerology Control Design for NR Qualcomm Incorporated
R1-1610131 NR numerology scaling and alignment Qualcomm Incorporated
R1-1610132 Advanced frame structure Qualcomm Incorporated
R1-1610133 Multi-TTI and size of slot/minislot and impact to mmW Qualcomm Incorporated
R1-1610134 Methodology for UE DOU analysis Qualcomm Incorporated
R1-1610135 Evaluation of frame structure design for UE power consumption Qualcomm Incorporated
R1-1610217 Resource assignment for mixed numerologies Panasonic
R1-1610228 Discussion on time domain structure for CP length KDDI Corporation
R1-1610307 Views on time domain structure for NR KT Corp.
R1-1610482 Way Forward on NR frame structure NTT DOCOMO

8.1.3 Channel coding and modulation for new radio interface

R1-1610878 Chairman's notes of AI 8.1.3 on channel coding and modulation for NR Ad-Hoc chair (Nokia)
The document was presented by Matthew Baker from Nokia.
Discussion: Rapporteur (Nokia)→ very tough sessions with both Wednesday & Thursday night sessions (finished around 1:00AM)
Huawei→ no issues to be reported but the notes are going to be endorsed without having all relevant delegates being present due to late ending time.
RAN1 Chair: agreed to come-back before meeting is over.
Decision: The document is finally endorsed and content incorporated below.

8.1.3.1 Channel coding

Includes choosing at least eMBB data channel coding scheme(s) and summarize observations that lead to the selection

Comparisons
R1-1610423 Summary of Channel Coding Simulation Data Sharing InterDigital Communications
Revision of R1-1609895
Companies are invited to check the results and provide any updates if available.
Further updated in R1-1610600.

R1-1608867 Considerations on performance and spectrum efficiency Huawei, HiSilicon
R1-1610059 Evaluation of LDPC codes for eMBB NTT DOCOMO, INC.
R1-1610138 Performance of EMBB channel codes with fading Qualcomm Incorporated

R1-1608770 Flexibility evaluation of channel coding schemes for NR CATT

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R1-1608584 Complementary turbo and LDPC codes for NR, motivated by a survey of over 100 ASICs AccelerComm Ltd
R1-1609070 Analysis on Trade-off between Performance and Complexity Samsung

R1-1610544 Observations on channel codes for NR eMBB data AccelerComm, Ericsson, Orange, IMT, LG, NEC, Sony
Proposed observations:

- LDPC codes are **proven, mature and capable**, at least when focusing on achieving **high throughputs**
- LDPC codes can deliver acceptable ~~meet the~~ BLER, **throughput**, latency, area-efficiency and energy-efficiency ~~requirements of~~ for NR, at least at **medium to high coding rates**
- Turbo codes are **proven, mature and capable**, at least when focusing on achieving **flexibility and HARQ**
- The LTE turbo code and enhanced LTE turbo codes can ~~meet~~ deliver acceptable ~~the~~ BLER, **flexibility, HARQ**, latency, area-efficiency and energy-efficiency ~~requirements~~ ~~of~~ for NR, at least at **medium to low coding rates.**
- Polar codes are ~~**not**~~ **less mature, at least for larger list sizes**.
- Polar....?
- Polar codes require **list decoding** to meet the BLER requirements of NR, which degrades the throughput, latency, area-efficiency and energy-efficiency of polar decoders.
- Turbo codes will be a **necessary part** of NR devices supporting non-standalone operation and/or legacy LTE connectivity ~~– efficiency improvements can be achieved by reusing the associated turbo code hardware for NR~~
- In some circumstances LDPC codes are more favourable than turbo codes. In other circumstances, turbo codes are more favourable than LDPC codes.
- LDPC and turbo codes are complementary, since they have different advantages and disadvantages.

R1-1610667 Way Forward on Channel Coding Observations Huawei, HiSilicon
Proposed observations:
Performance:

- Polar vs. LDPC
  - For list 32 decoder for Polar, Polar has better BLER performance compared to LDPC for the evaluated info block lengths [Huawei R1-1608864, ZTE R1-166411, Spreadtrum R1-1608922]
  - For list 8 decoder for Polar, Polar has better BLER performance compared to LDPC for the evaluated info block lengths/code rates except for high coding rates and large info block size [Huawei R1-1608864]
  - For list 4 decoder for Polar, Polar has better BLER performance compared to LDPC for small info block [Nokia R1-1609583]
- Polar vs. LTE Turbo
  - For list 32 decoder for Polar, Polar has better BLER performance compared to Turbo for the evaluated info block lengths [Huawei R1-1608864, Huawei R1-164377, QC R1-164700, ZTE R1-166411, Spreadtrum R1-1608922, DCM R1-1610060, CATR R1-1609578]
  - For list 8 decoder for Polar, Polar has better BLER performance compared to Turbo for the evaluated info block lengths and coding rates except rate 1/3 [Huawei R1-1608864, DCM R1-1610060]
  - For list 4 decoder for Polar, Polar has better BLER performance compared to Turbo for small info block [Nokia R1-1609583]
- Polar vs. TBCC
  - For list 32 decoder for Polar, Polar has better BLER performance compared to TBCC for info block lengths up to 200 bits [Huawei R1-1608863, ZTE R1-1608973, CATT R1-1608771, Intel R1-167703, CATR R1-1609579]
  - For list 4 decoder for Polar, Polar has better BLER performance compared to TBCC for info block [Nokia R1-1609589, Nokia R1-1609594]

Flexibility:

- For Polar, 1-bit granularity can be achieved for all coding rates and for full range of block size
  - [Huawei R1-167209],[Intel R1-164184]
- For LDPC, 1-bit granularity cannot be achieved with reasonable implementation complexity, due to multiple PCMs needed to support all coding rates with a complex switch network
  - [Samsung R1-166771],[Qualcomm R1-1610137],[Nokia R1-1609584],[Samsung R1-1609067]
- For Turbo, 1-bit granularity is feasible for all coding rates and for full range of block size

Implementation complexity:

- For polar, list 8 decoder is deemed implementable for all info block size and list 32 is deemed implementable for small info block size
  - [Huawei R1-1608865] [MediaTek R1-1609336]
- For LDPC, LOMS/LNMS decoder with iterations up to 25 is deemed implementable for info block granularity coarser than LTE

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  - [Qualcomm R1-1610139],[MediaTek R1-1609337],[Nokia R1-1609584],[Samsung R1-1609067]
- For Turbo, decoder complexity is impractical for large info block size

Latency:
- For Polar
  - with list 8 decoder, a decoding latency of 16us can be met for all info block length
    - [Huawei R1-1608865]
  - with list 32 decoder, a decoding latency of 1.7us can be met for small info block length (80bit)
    - [Huawei R1-1608865]
- For LDPC, a latency of 16us can be met for all info block length
  - [Qualcomm R1-166372]
- For Turbo, a latency of 16us can be met for small info block length

R1-1610690 Way forward on observations for eMBB data channel coding Samsung, Qualcomm Incorporated, Nokia, ASB, KT Corporation, Intel Corporation

Proposed observations:
Summary:
- LDPC codes can efficiently support the whole range of eMBB data channel rates, block lengths, and IR HARQ with fine granularity
- LDPC codes can provide better area and energy efficiency than other coding schemes, especially for high throughput
- LDPC codes are amenable to parallelization and can provide better decoding latency

Rate flexibility:
- LDPC code can support multiple codes rates, and HARQ, including IR-HARQ by extension of parity check matrix
  - Multiple LDPC code families can be compactly and efficiently described
  - Decoder does not need to carry complexity of mother code on early transmissions, and performance is comparable to Turbo codes

Length flexibility:
- Shortening together with lifting and rate-matching allows LDPC code support information block size and codeword length flexibility with 1-bit granularity
  - The additional HW complexity for supporting a flexible LDPC code with arbitrary sub-block size is not a problem, as compared with that of inflexible LDPC codes.

Implementation:
- LDPC implementation complexity can be better than other codes when LDPC can support flexibility
  - The energy and area efficiencies of a flexible LDPC decoder is better than those of LTE turbo codes.
- Implementation complexity point of view, LDPC is better than other coding schemes especially for high throughput

Performance:
- LDPC codes can support stable performance for various MCS with fine granularity, comparable or better to other codes with similar decoding complexity

- Observations:
- Performance
  - The performance of LDPC, Polar and Turbo codes is captured in R1-1610600 (update of R1-1610423).
    - It has not yet been possible to draw conclusions directly from these captured results, owing to different views on the implementation complexities and possible enhancements which are discussed in more detail below.
- Flexibility for code rate and code block size support
  - LDPC, Polar and Turbo codes can all deliver acceptable flexibility.
- Chase- and IR-HARQ support
  - The proponents of LDPC and Polar have shown schemes for support of both CC- and IR-HARQ in their respective codes
    - Some companies have concerns on the incremental freezing method of HARQ support for Polar codes
    - One company has concerns on the complexity of IR-HARQ for LDPC codes
  - The ability of Turbo codes to support both CC- and IR-HARQ is well known
- Implementation complexity
  - LDPC:

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- LDPC codes are widely implemented in commercial hardware supporting several Gbps throughput and attractive area and energy efficiency with some flexibility, but with flexibility and features that are more limited than required for NR; in relation to NR, there are concerns summarised below.
- The area efficiency reduces for lower coding rates
- The complexity of LDPC increases with increasing flexibility
- Proponents consider LDPC codes with limited flexibility to provide the most attractive area and energy efficiency, and that the characteristics of LDPC codes in area and energy efficiency remain advantageous even when supporting full flexibility, while some other companies consider the applicable flexibility to be limited, for example because a flexible switched network (if used) has an impact on increasing the power, area and latency
- LDPC codes are amenable to parallelisation which can provide better decoding latency
  - Depending on the parity check matrix design, some of this parallelism may not be exploited for all code block lengths for NR, and some companies have a concern with this and its impact on energy and area efficiency
- Some variants of min-sum based iterative decoders are considered implementable, and allow a trade-off between complexity and performance
- Two proponents consider quasi-ML decoders (e.g. list 32, ordered stochastic decoding) implementable for codeword sizes up to 1k
- BP and sum-product decoders are not considered implementable for NR by some companies
- For LDPC there are concerns that implementation with attractive area and energy efficiency may be challenging when simultaneously targeting the peak throughput and flexibility requirements of NR

o Polar:
- Polar codes are implementable, although there are currently no commercial implementations, and in relation to NR, there are some concerns as summarised below.
- The area efficiency reduces for shorter block lengths and lower coding rates
- For list decoders, the implementation complexity increases with increasing list size, especially with larger block sizes
  - Some companies consider that a List 32 decoder is implementable up to a codeword size N of at least 1k (with larger codeword sizes requiring a segmented design), although some other companies have concerns on the achievable performance (including area efficiency, hardware throughput)
  - Some companies consider that a List 8 decoder is implementable for codeword sizes N up to 4k (with larger codeword sizes requiring a segmented design)
  - List 4 decoder is considered implementable for codeword sizes N up to at least 2k, with some companies considering it implementable up to 8k (with larger codeword sizes requiring a segmented design)
  - List 1 is considered implementable
- For decoding hardware that can achieve acceptable latency, performance and flexibility, there are some concerns about the area efficiency and energy efficiency that are achievable with polar codes

o Turbo:
- Turbo codes are widely implemented in commercial hardware, supporting HARQ and flexibility similar to what is required for NR, but not at the high data rates or low latencies required for NR; in relation to NR, there are concerns summarised below.
- Proponents consider some implementations of turbo codes to meet the flexibility requirements of NR with the most attractive area and energy efficiency except at higher throughputs, and particularly at lower code rates and lower block lengths
  - Other companies consider that the latency and area and energy efficiency are not adequate for NR, and that the area and energy efficiency reduces at lower block lengths
  - Only two of the proponents of turbo codes propose turbo codes for the higher throughputs for NR
- In some implementations suitable for lower throughputs, the area and energy efficiency is constant when varying the puncturing and repetition rate.
  - Otherwise, this is not the case, e.g. in some implementations designed for higher data rates
- The decoding complexity increases linearly with the information block size for a given mother code rate
- The decoding complexity increases as the contraint length increases, and to a lesser extent as the mother code rate reduces
- For turbo codes, there are concerns that implementation with attractive area and energy efficiency is challenging when targeting the higher throughput requirements of NR
- Some advanced turbo decoders are considered implementable, and allow a tradeoff between complexity and performance.
- Some companies consider quasi-ML decoders are implementable for shorter information block lengths and codeword sizes up to 1k

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        - The proponents consider that a turbo decoder could be designed that would be capable of decoding both LTE and at least small information block sizes (K<=6144) of NR
            - Other companies consider that such reuse would be subject to multiple concerns or would not be possible
- Latency
    - The proponents of all three coding families consider that their respective codes can fulfil the NR latency requirements
        - Latency-wise, highly-parallelised decoders, as applicable for LDPC, and turbo according to some proponents, can help to reduce latency
        - Although polar codes are not highly parallelisable, proponents consider that there are other design techniques that can help to reduce latency for polar decoders
        - Some companies consider that polar codes may be able to achieve lower latency for decoding of small (around 1000 bits) blocks if capability of decoding large blocks is not considered; however, some other companies consider that polar decoders incurs longer latency than turbo decoders
- Other considerations
    - Turbo and LDPC are similarly well established, while Polar is less well established, being the newest among the three. All of the code families require effort at least in specification design, in order to meet the NR requirements. Some companies consider that less well established technologies require more effort.

R1-1610981 WF on observations of eMBB data channel coding for short block length InterDigital
Further revised in R1-1610993
R1-1610931 WF on channel coding observations for short block size IMT, Orange, AccelerComm, Ericsson, LG, NEC

R1-1610604 WF on channel codes for NR eMBB data AccelerComm, Ericsson, Orange, IMT, LG, NEC, Sony
Revision of R1-1610545
Proposal:
- Adopt LDPC code and turbo code, to mitigate the concerns associated with the implementation of flexible LDPC

R1-1610767 Way forward on eMBB data channel coding Samsung, Qualcomm Incorporated, Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless, KT Corporation, KDDI, ETRI, IITH, IITM, CEWiT, Reliance Jio, Tejas Network, Xilinx, Sony, SK Telecom, Intel Corporation, Sharp, MTI, National Instrument, Motorola Mobility, Lenovo, Cohere Technologies, Acorn Technologies, CableLabs, WILUS Inc, NextNav, ASUSTEK, ITL
Revision of R1-1610689
Also acceptable to Ericsson
Proposal:
- Adopt LDPC code for eMBB data channel as single coding scheme

R1-1610850 WF on channel codes Huawei, HiSilicon, Acer, Bell, CATR, China Unicom, China Telecom, CHTTL, Coolpad, Deutsche Telekom, Etisalat, InterDigital, III, ITRI, MediaTek, Nubia Technology, Nuel, OPPO, Potevio, Spreadtrum, TD Tech, Telus, Vivo, Xiaomi, Xinwei, ZTE, ZTE Microelectronics
Revision of R1-1610668
Also acceptable to CATT
Proposal:
- Polar code is supported as a channel coding scheme for NR eMBB data channel

R1-1610607 Way Forward on Channel Coding ZTE, ZTE Microelectronics, Acer, Bell, CATR, China Unicom, China Telecom, CHTTL, Coolpad, Deutsche Telekom, Etisalat, Huawei, HiSilicon, InterDigital, III, ITRI, MediaTek, Nubia Technology, Neul, OPPO, Potevio, Shanghai Tejet, Spreadtrum, TD Tech, Telus, Vivo, Xiaomi, Xinwei, IITH, IITM, CEWiT, Reliance Jio, Tejas Network

Question: How many channel coding schemes should be specified for the NR eMBB data channel:
- 1:
    - LDPC: Ericsson, Sony, Sharp, Nokia, ASB, Samsung, Intel, QC, VzW, KT, IITH, IITM, Fujitsu, MotM, Lenovo, KDDI
    - Polar: HW
- >1:
    - T+L Accelercomm, IMT, LG, NEC, Fujitsu, Orange
    - L+P ZTE, Etisalat, Mediatek, Nubia, Xiaomi, Coolpad, Neul, HW devices, OPPO, CATR, TDTech, Spreadtrum, Potevio, ITRI, IDC, DT, NTU

Note that the above questions give an approximate picture, though not necessarily complete.

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Possible Agreements:
Alt 1:
- The channel coding scheme for eMBB data is LDPC

No: HW, IDC, HiSi, DT, NEC, CMCC, LG, Spreadtrum, Neul, CATR, Xinwei, TDTech, OPPO, Coolpad, Xiaomi, HW Devices, ITRI, Mediatek, Accelercom, Nubia, IMT, Orange, ZTE, ZTE Microelectronics

Alt 2:
- The channel coding scheme for eMBB data is LDPC, at least for blocks larger than X
- Polar coding is supported for eMBB data for blocks smaller than X

No: Sams, NEC, Intel, QC, LG, Nokia, ASB, MotM, Lenovo, KT, Ericsson, CableLabs, ITL, Sequans, Acorn, Asustek, Mitsubishi, KDDI, Wilus, Accelercom, IMT, Orange, Sony, Sharp, Fujitsu, VzW, Docomo

Alt 3:
- The channel coding scheme for eMBB data is LDPC, at least for blocks larger than X
- Turbo coding is supported for eMBB data for blocks smaller than X

No: HW, IDC, HiSi, Sams, Nok, ASB, KT, QC, Asustek, Spreadtrum, Mitusbishi, CATR, Xinwei, TDTech, OPPO, Intel, Coolpad, Neul, Wilus, Xiaomi, ITRI, Mediatek, Nubia, ZTE, ZTE Microelectronics, HW Devices, CableLabs, ITL, DT, VzW, KDDI, Acorn, Docomo

Agreement:
- The channel coding scheme for eMBB data is LDPC, at least for information block size > X
- FFS until RAN1#87 one of Polar, LDPC, Turbo is supported for information block size of eMBB data <= X
  - The selection will focus on all categories of observation, including overall implementation complexity, regardless of the number of coding schemes in the resulting solution (except if other factors are generally roughly equal)
- The value of X is FFS until RAN1#87, 128 <= X <= 1024 bits, taking complexity into account
- The channel coding scheme(s) for URLLC, mMTC and control channels are FFS

~~Huawei has a concern on the upper value of the range of X to be considered.~~

Friday:

Huawei asked adding a note "RAN1 needs to conclude on performance observations of channel coding"
Samsung: why are we re-opening an already endorsed report of the session
Intel: same view – object touching the conclusions again
Sharp: there is no reason to formalize this – there are already a lot of results provided by companies
Ericsson/Fujitsu: RAN1 knows what to do till the next meeting, just let's do it – all we have is sufficient to let the work continue and progress
ZTE support Huawei's view
Qualcomm: a lot of time was spent during the long sessions on channel coding w.r.t performance analysis – there is still time for contributions to be proposed
Nokia: clearly drawing conclusion on the observations was very difficult – let's now focus on the technical work & design
CATT: would like not to forget about the conclusion – support Huawei
Nokia (rapporteur of the session): suggested adding the following sentence "RAN1 is still encouraged to strive to draw additional conclusions on the performance of channel coding"
Samsung; OK with the above statement but recalled that companies had a lot of time to comment during the online session
Fujitsu: also Ok but suggested that such statement should be included in the overall agreement

Ericsson: "conclusions" means all characteristics including complexity/ latency/… - would like to replace that wording by "observations" only
Finally the note "Huawei has a concern on the upper value of the range of X to be considered." is withdrawn and RAN1 chair concluded as follows:

Conclusion: RAN1 is still encouraged to strive to draw additional observations and conclusions on the performance of channel coding

LDPC details

R1-1610137	LDPC rate compatible design overview	Qualcomm Incorporated
R1-1608875	LDPC Code Design for NR	Ericsson
R1-1608866	Evaluation of LDPC performance	Huawei, HiSilicon
R1-1609064	IR-HARQ Performance of Rate-Compatible Quasi-Cyclic LDPC Codes	Samsung
R1-1609588	False alarm rate of LDPC decoding and CRC requirement	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609067	Evaluation of HW Complexity for Flexible Quasi-Cyclic LDPC Codes	Samsung

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Polar details

R1-1608862 Polar Code Construction for NR Huawei, HiSilicon
R1-1610420 Resolving Polar code memory complexity issue MediaTek Inc.
Revision of R1-1609338
R1-1609587 Design and performance of polar codes for eMBB Nokia, Alcatel-Lucent Shanghai Bell
R1-1610060 Evaluation of polar codes for eMBB NTT DOCOMO, INC.
R1-1608977 On the maturity of polar decoders, based on a survey of over 150 hardware implementations AccelerComm Ltd

R1-1608865 Design aspects of Polar Code/LDPC for NR Huawei, HiSilicon

Turbo details

R1-1608768 Performance of Turbo codes with high speed decoding algorithm for NR CATT
R1-1609246 Turbo code enhancement LG Electronics

Other

Friday

R1-1611059 Way Forward on Data Sharing Qualcomm

Discussion:

Sony: concern regarding the kind of QAM going to be addressed
Huawei: failed to understand the purpose as all 3GPP contributions are publicly available – would be ok agreeing on the spreadsheet
ZTE: why do we need a new process?
Nokia: nothing new but an update of the existing process, with a formal folder where data can be stored and shared amongst interested – email could be useful

Decision: The document is noted and for email discussion until October 20th – (Qualcomm)

Not treated.

R1-1608769 Discussion on implementation of high speed Turbo decoder for NR CATT
R1-1608771 Evaluation of channel coding schemes for NR control channels CATT
R1-1608772 LDPC codes design for eMBB CATT
R1-1608863 Evaluation of channel coding schemes for control channel Huawei, HiSilicon
R1-1608871 On TBCC Generator Polynomials Ericsson
R1-1608872 Study of LDPC Codes for Control Channel of NR Ericsson
R1-1608873 Study of Polar Codes for Control Channel of NR Ericsson
R1-1608874 Performance Comparison of Channel Coding Candidates for Short Block Lengths Ericsson
R1-1608876 LDPC Code Performance with Rate Matching Ericsson
R1-1608877 On Achieving Low Code Rate with LDPC Codes Ericsson
R1-1608878 Updated Survey of Channel Coding Implementations Ericsson
R1-1608879 Implementation Consideration of Channel Coding Options for NR Ericsson
R1-1608921 Code segmentation and CRC issues for LDPC codes Spreadtrum Communications
R1-1608922 Performance analysis of channel coding schemes for NR Spreadtrum Communications
R1-1608971 Consideration on the flexibility of LDPC codes for NR ZTE
R1-1608972 Consideration on channel coding candidates for NR eMBB ZTE
R1-1608974 Consideration on LDPC design for NR ZTE
R1-1608975 Consideration on polar codes for NR ZTE
R1-1608976 Consideration on outer codes for NR ZTE
R1-1609063 Summary of Channel Coding for NR Samsung
R1-1609065 Length-Compatible Quasi-Cyclic LDPC Codes Samsung
R1-1609066 Decoder Architecture for Length-Compatible Quasi-Cyclic LDPC Codes Samsung
R1-1609068 Discussion on Maximum Code Block Size Samsung
R1-1609069 Design of Short-Length LDPC Codes Samsung
R1-1609071 Cross check results of LDPC code proposal Samsung
R1-1609072 Performance of Short-Length Polar Codes Samsung
R1-1609073 Discussion on latency of channel codes for NR Samsung
R1-1609239 HARQ of LDPC code for NR LG Electronics
R1-1609240 Comparison of complexity for turbo and LDPC codes LG Electronics
R1-1609241 Consideration on implementation of flexible channel decoder LG Electronics
R1-1609242 Length flexibility of QC-LDPC LG Electronics
R1-1609243 Channel coding selection of eMBB scenario LG Electronics
R1-1609244 Control channel coding scheme evaluation LG Electronics
R1-1609245 Multiple CRC for TBCC list decoding LG Electronics

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R1-1609385 Link level analysis for channel coding schemes for control channel AT&T GNS Belgium SPRL
R1-1609389 On the channel coding scheme for NR NEC
R1-1609439 Further results on channel coding schemes for NR Huawei, HiSilicon
R1-1609511 Discussion on Data channel coding for NR Intel Corporation
R1-1609512 Discussion on Control channel coding for NR Intel Corporation
R1-1609578 Some simulation results for eMBB CATR
R1-1609579 Simulation results for control channel CATR
R1-1609582 Selection of eMBB coding scheme Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-1609583 Update on eMBB coding performance Nokia, Alcatel-Lucent Shanghai Bell
R1-1609584 LDPC link design for eMBB Nokia, Alcatel-Lucent Shanghai Bell
R1-1609585 IR HARQ schemes for LDPC Nokia, Alcatel-Lucent Shanghai Bell
R1-1609586 Discussion on the IR-HARQ support of polar codes Nokia, Alcatel-Lucent Shanghai Bell
R1-1609589 Performance of coding candidates for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1609590 Polar codes for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1609591 Reed-Muller and BCH codes for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1609592 LDPC codes for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1609593 Evaluation criteria for URLLC/mMTC coding scheme Nokia, Alcatel-Lucent Shanghai Bell
R1-1609594 Performance of mMTC and URLLC channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell
R1-1609614 NR DL Control Channel Coding Selection from UE Perspectives MediaTek Inc.
R1-1609708 Discussion of QC-LDPC code design with regular degree-3 for NR National Taiwan University
R1-1609896 Performance Evaluation of Channel Codes for eMBB Control Channel InterDigital Communications
R1-1609897 Updated LDPC Simulation Data Sharing InterDigital Communications
R1-1609898 Performance Evaluation of Puncturing Schemes for Polar Codes InterDigital Communications
R1-1609899 Interleaver for Polar Codes InterDigital Communications
R1-1610136 LDPC for EMBB and URLLC Qualcomm Incorporated
R1-1610140 LDPC decoding with adjusted min-sum Qualcomm Incorporated
R1-1610141 Short blocklength design Qualcomm Incorporated
R1-1610143 Erasure coding and HARQ design Qualcomm Incorporated
R1-1610314 FEC performance comparison for short frame sizes for NR IMT, ORANGE
R1-1610350 Latency consideration of channel coding candidates for URLLC National Taiwan University
R1-1610411 URLLC channel coding Qualcomm Incorporated
R1-1610417 Data Sharing on NR Channel Coding Simulation Results MediaTek
R1-1610419 UE considerations on coding combination for NR data channels MediaTek Inc.
R1-1610472 Evaluation of Adjusted-Min-Sum LDPC Decoder and Complexity Aspects of Permutation Networks Huawei, HiSilicon
R1-1610580 Performance Evaluation for NR Channel Coding Huawei, HiSilicon
R1-1610600 Updated Summary of Channel Coding Simulation Data Sharing for eMBB Data Channel InterDigital Communications
R1-1610659 Evaluation on channel coding candidates for eMBB control channel_Figures ZTE
R1-1610660 Evaluation on channel coding candidates for uRLLC and mMTC ZTE
R1-1610678 Efficient Channel Coding Implementations for EMBB Qualcomm Incorporated
R1-1610682 Channel Coding scheme for EMBB Intel Corporation
R1-1610691 Way Forward on Channel Coding Design for NR Ericsson
R1-1610692 Way Forward on Further Evaluation Assumptions of Control Channel Ericsson
R1-1610757 Observations on hardware implementations of flexible channel decoders AccelerComm
R1-1610807 Clarification on IF-HARQ for PC-Polar Huawei, HiSilicon
R1-1610821 Observations on hardware implementations of flexible LDPC decoders AccelerComm
R1-1610822 Observations on hardware implementations of flexible polar decoders AccelerComm
R1-1610842 Implementation considerations on flexible and efficient LDPC decoders MediaTek Inc.
R1-1610857 Observations on Performance and Implementation Issues of AdjMS decoders Huawei, HiSilicon
R1-1610982 WF on NR channel coding selection CMCC
R1-1610984 Way Forward on Basics of LDPC Design Ericsson, Intel, Qualcomm, NTU, Nokia, ASB, LG, Samsung

8.1.3.2 Modulation

R1-1610904 Way Forward on Low PAPR Modulation in NR Samsung, ~~Qualcomm~~, Intel, Vodafone, AT&T, MediaTek, KDDI, InterDigital, IITH, IITM, Tejas Networks, Reliance-Jio, CEWiT, National Instruments
Note: WF is not co-sourced by Qualcomm
R1-1610799 WF on Modulation for NR InterDigital, Qualcomm, Mediatek, Sony, Orange, Huawei, HiSilicon

R1-1608870 Advanced modulation for NR Huawei, HiSilicon
R1-1608935 Evaluation of NU-QAM for NR Sony
R1-1608936 Signal Space Diversity Use in NR Sony
R1-1609074 Evaluation Assumptions for NR Modulation Schemes Samsung

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R1-1609075 Discussion on modulation for MIMO Samsung
R1-1609076 Modulation scheme for interference management in NR Samsung
R1-1609077 Performance evaluation of MLC with natural mapping for MIMO Samsung
R1-1609078 Low PAPR modulation and waveform Samsung
R1-1609513 Modulation schemes for New RAT Intel Corporation
R1-1609595 Digital Modulation for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1609632 On modulation schemes for NR Ericsson
R1-1609900 Performance Evaluation of Dual Carrier Modulation for New Radio InterDigital Communications
R1-1609901 Evaluation of Spatial Modulation with Spatial Correlation and Imperfect Channel Estimation InterDigital Communications
R1-1609902 On Fractional N-ary Modulation for NR InterDigital Communications
R1-1610144 Evaluation assumptions for NR modulation schemes Qualcomm Incorporated
R1-1610777 Way Forward on NR modulation for high spectral efficency Samsung, Qualcomm, Intel, IITH, Tejas Networks, IITM, CeWiT, Reliance Jio, KDDI

R1-1610211 Way Forward on modulation for NR Nokia, Alcatel-Lucent Shanghai Bell

Agreements:

- The same constellation mapping as used in LTE (i.e. QPSK, 16QAM, 64QAM and 256QAM) is introduced, while not precluding other constellation mappings
  - Note that there might be possibility to exclude some of above constellation mapping based on the further study
- Enhancement modulation schemes for further study include
  - Higher order modulation in conjunction with MIMO
  - Constellation mapping among subcarriers
  - Other constellations (e.g., non-uniform QAM)
  - Coded modulations
  - Spatial modulation
  - Mappings of bits to symbol(s)
  - Rotated-QAM up to BPSK, QPSK
    - $k\pi$-QAM (0<k<=1)
      - FFS k (e.g., k = 0.5 for BPSK, 0.25 for QPSK)
  - Constellation Interpolation
  - Note: Other modulation schemes or combinations of the above schemes are not precluded
  - Note: Proponents should describe the details of the receivers

8.1.4 Multi-antenna scheme for new radio interface

R1-1608660 Unified MIMO framework for NR above and below 6GHz ZTE, ZTE Microelectronics
R1-1609690 Views on Framework of NR MIMO and Beam Management Beijing Xinwei Telecom Techn.
R1-1609904 Impact of UE Calibration in a Reciprocity-based UL MIMO Transmission InterDigital Communications
R1-1610974 Outcomes of Thursday offline session on NR MIMO Samsung

8.1.4.1 Beam management

R1-1609248 On the impact of UE rotation LG Electronics

The document was presented by … from LGE.

Proposal 1: UE triggering based beam management should be supported in NR.
Proposal 2: Consider omni-directional single or cross-pol antenna for UE above 6 GHz.
Proposal 3: (Semi) OL MIMO techniques can be taken into consideration when UE rotates.
Proposal 4: UE centric MCS back-off mechanisms should be studied for NR.

Decision: The document is noted.

R1-1609395 Discussion of DL hybrid beamforming procedure Lenovo

The document was presented by … from Lenovo.

Proposal 1: RSRP-based beam measurement and feedback scheme should be considered for beam selection and refinement.
Proposal 2: Spatial multiplexing at the TRP should be supported by the beam measurement and feedback scheme.
Proposal 3: The standard impact of UE RX beam selection and refinement should be minimized, provided a UE is provided sufficient RS resource to tune its RX beam.
Proposal 4: CSI-RS and feedback can be used for CSI acquisition for given analog beams.
Proposal 5: The interaction between analog beaming and digital beamforming should be studied.

Decision: The document is noted.

R1-1609754 Beam management principles Ericsson

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The document was presented by Mattias Frenne from Ericsson.

- Proposal 1: Handle beam management within the CSI framework in NR (i.e. the framework used for link adaptation of data transmission).
- Proposal 2: Use CSI-RS for beam management measurements
- Proposal 3: In the beam management procedures, one or multiple beam pair links (BPLs) are monitored by the network using uplink measurements by the TRPs and/or downlink measurements from the UE.
- Proposal 4: Support a configurable (time multiplexed, frequency multiplexed or both) sweepof CSI-RS in a slot or subframe for beam management measurements
- Proposal 5: Study which different types of frequency allocations that should be supported for CSI-RS used for beam management measurements
- Proposal 6: When triggering a sweep of K CSI-RS transmissions (K beams), it is also indicated to the UE whether it may assume that the same beam is used for the K transmissions or not as to distinguish between P-1/P-2 and P-3 procedure.

Decision: The document is noted.

R1-1610487 Way Forward on beam management Ericsson, Intel, CATT, InterDigital Communications

The document was presented by Mattias Frenne from Ericsson.

- At least CSI-RS can be used for measurements to support the beam management processes P1, P2, P3
  - When used for P1/P2/P3, the CSI-RS signal structure can be specifically optimized for this purpose (as opposed to e.g. link adaptation)
  - Additional RS could also be considered such as DMRS and synchronization signals

Decision: The document is noted.

Possible agreements:

- At least CSI-RS can be used for measurements to support the beam management processes P1, P2, P3
  - When used for P1/P2/P3, optimization of the CSI-RS signal structure can be considered for this purpose (as opposed to e.g. link adaptation)
  - Additional RS could also be considered such as DMRS and synchronization signals

R1-1610516 Way Forward on Beam management RS Samsung, Intel, Verizon Wireless

The document was presented by Young Han Nam from Samsung.

- NR supports two types of RS for beam management procedures (P-1, P-2 and P-3) :
  - Beam reference signals (BRS):
    - BRS is cell-specifically configured and periodically transmitted.
    - FFS: BRS is also used for L3 mobility
  - CSI-RS:
    - CSI-RS is UE-specifically configured.
    - The signal structure for CSI-RS can be specifically optimized based on whether -the CSI-RS is used for P1, P2 or P3
    - Note: CSI-RS is also used for CSI acquisition

Decision: The document is noted.

Possible agreements:

- NR supports two types of RS for beam management procedures :
  - Beam reference signals (BRS) at least in P-1:
    - BRS is periodically transmitted
      - FFS: Cell-specific configuration or UE-specific configuration
    - FFS: BRS is also used for L3 mobility
  - CSI-RS in P-2, and P-3:
    - CSI-RS is UE-specifically configured.
    - The signal structure for CSI-RS can be specifically optimized based on whether the CSI-RS is used for P1, P2 or P3
    - Note: CSI-RS is also used for CSI acquisition
  - Additional RS could also be considered such as DMRS and synchronization signals

Possible agreements:

- NR supports at least CSI-RS for beam management procedures (P-1, P-2 and P-3) :
  - CSI-RS is UE-specifically configured.
  - The signal structure for CSI-RS can be specifically optimized based on whether the CSI-RS is used for P1, P2 or P3
  - Note: CSI-RS is also used for CSI acquisition

Continue offline discussions about the necessity to support Beam reference signals (BRS) – Young Han (Samsung)
Continue offline discussion until Tuesday – Mattias (Ericsson), Young Han (Samsung)

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Tuesday

R1-1610658 Way Forward on beam management Ericsson, Samsung, Intel

- Beam management procedures can utilize at least the following two RS types:
  - RS used for mobility, at least for P-1:
    - Note: This RS can be used for P-1 when beam sweeping of mobility signal is used
  - CSI-RS, for P-1, P-2, and P-3:
    - CSI-RS is UE-specifically configured.
      - Multiple UE may be configured with the same CSI-RS
    - The signal structure for CSI-RS can be specifically optimized based on whether the CSI-RS is used for P1, P2 or P3
    - Note: CSI-RS can also be used for CSI acquisition
    - Note: The CSI-RS can be used for P-1 in case mobility signal is single beam or when SFN transmission is used, e.g. across multi-TRP/Panel
- Additional RS could also be considered such as DMRS and synchronization signals

Decision: The document is noted. Also supported by Interdigital, CATT.

Working assumptions:

- Beam management procedures can utilize at least the following RS type(s):
  - RS defined for mobility purpose at least in connected mode
    - FFS: RS can be NR-SS or CSI-RS or newly designed RS
      - Others are not precluded
  - CSI-RS:
    - CSI-RS is UE-specifically configured
      - Multiple UE may be configured with the same CSI-RS
    - The signal structure for CSI-RS can be specifically optimized for the particular procedure
    - Note: CSI-RS can also be used for CSI acquisition
- Other RS could also be considered for beam management such as DMRS and synchronization signals

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Wednesday session

R1-1610512 Way Forward on Group-based beam managementZTE, ZTE Microelectronics

- Definition of beam grouping:
  - Beam grouping = for TRP(s) or UE to group multiple Tx/Rx beam(s) or beam pair(s) into one subset of beams sharing similar channel properties
- Group based beam management is supported at least in the following aspects:
  - Beam-group based RSRP/CSI reporting
    - e.g. Beam grouping is done on Tx beams sharing similar channel properties, like angles of arrival and departure, QCL and TA. UE reports RSRP/CSI with the best beam in each of the M beam groups
  - Beam-group based indication for beam measurement, beam-based transmission or beam switching
    - e.g. TRP indicates beam group which conveys the information on how UE should receive the beam e.g. which Rx beam is used
    - e.g. TRP/UE indicates intra-group beam measurement. Beam switching on one side within a group, if any, is agnostic to the other side.
    - e.g. TRP/UE indicates inter-group beam measurement. Beam group switching on one side, if any, is informed to the other side.

Decision: The document is noted. Revised in:

R1-1610891 WF on Group-based Beam Management ZTE, ZTE Microelectronics, ASTRI, Nokia, ASB, CATT

Decision: The document is noted. Continue offline.

Agreements:

- Group based beam management is to be further studied:
  - Definition of beam grouping:
    - Beam grouping = for TRP(s) or UE to group multiple Tx and/or Rx beam(s) and/or beam pair(s) into one subset of beams
  - FFS detailed mechanisms for beam grouping, reporting, beam-group based indication for beam measurement, beam-based transmission or beam switching, etc.
    - Some examples can be found in R1-1610891 and R1-1609414

R1-1610825 WF on Beam management CATT, CATR, CMCC, Xinwei

Decision: The document is noted. Continue offline.

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Agreements:

- For downlink, NR supports beam management with and without beam-related indication
  - When beam-related indication is provided, information pertaining to UE-side beamforming/receiving procedure used for data reception can be indicated through QCL to UE
    - FFS: Information other than QCL
  - FFS: When beam-related indication is provided, information pertaining to the Tx beam used for data transmission is indicated to UE
- For downlink, based on RS (used for beam management) transmitted by TRP, UE reports information associated with N selected Tx beams
  - Study how the N Tx beams can be selected
  - Study the case where N comprises of all Tx beams
  - Study UE reporting information
  - Note: N can be equal to 1

R1-1610510 Way Forward on Beam reporting for NR LG Electronics, Intel

- Support both network initiated and UE initiated aperiodic beam reporting.
  - Aperiodic beam reporting can be associated with P-1, P-2, and P-3.
  - UE request message can be transmitted on a reserved/dedicated uplink channel (e.g. physical random access channel, physical uplink control channel).
- Further study is needed whether network/UE initiated semi-persistent/periodic beam reporting is needed.

Decision: The document is noted.

Possible agreements:

- Support at least network initiated aperiodic beam reporting
  - Aperiodic beam reporting can be associated with P-1, P-2, and P-3.
  - FFS: UE request message can be transmitted on a reserved/dedicated uplink channel (e.g. physical random access channel, physical uplink control channel)
  - FFS: UE initiated aperiodic beam reporting case
- Further study is needed whether network/UE initiated semi-persistent/periodic beam reporting is needed.

Continue offline.

R1-1610923 WF on Beam Reporting for NR LG Electronics, Intel, NTT DOCOMO, MediaTek

Agreements:

- Support at least network triggered aperiodic beam reporting:
  - Aperiodic beam reporting is supported under P-1, P-2, and P-3 related operations
  - FFS beam reporting details
  - FFS: UE assisted/initiated aperiodic beam reporting
  - FFS: In case of UE assisted/initiated aperiodic beam reporting, UE request message can be transmitted on a reserved/dedicated/common uplink channel (e.g. physical random access channel, physical uplink control channel).
- Further study is needed whether semi-persistent/periodic/event-triggered beam (network triggered or UE assisted/initiated) reporting is needed

R1-1610511 WF on Beam Management for DL Control Channel ZTE, ZTE Microelectronics , Intel, Xinwei

Agreements:

- Support using same or different beams on control channel and the corresponding data channel transmissions
  - FFS the antenna ports for control channel and the corresponding data channel (e.g., sharing some ports or not)
- Study detailed aspects related to beams/beam pairs indication/reporting involving usage of control and data channels and involving one or more TRPs

R1-1610971 WF on definition of Beam reciprocity Samsung, Qualcomm, InterDigital, Intel, IITM, IITH, CeWIT, Tejas Networks, KT, MediaTek, AT&T, Verizon, Motorola Mobility, Reliance Jio

Working assumption:

- The followings are defined as Tx/Rx beam correspondence at TRP and UE :
- Tx/Rx beam correspondence at TRP holds if at least one of the following is satisfied:
  - TRP is able to determine a TRP Rx beam for the uplink reception based on UE's downlink measurement on TRP's one or more Tx beams.

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        - TRP is able to determine a TRP Tx beam for the downlink transmission based on TRP's uplink measurement on TRP's one or more Rx beams
    - Tx/Rx beam correspondence at UE holds if at least one of the following is satisfied:
        - UE is able to determine a UE Tx beam for the uplink transmission based on UE's downlink measurement on UE's one or more Rx beams.
        - UE is able to determine a UE Rx beam for the downlink reception based on TRP's indication based on uplink measurement on UE's one or more Tx beams.
    - More refined definition can still be discussed

R1-1610894 UL beam management Samsung, Huawei, Intel

Agreements:

- UL beam management is to be further studied in NR
    - Similar procedures can be defined as DL beam management with details FFS, e.g.:
        - U-1: is used to enable TRP measurement on different UE Tx beams to support selection of UE Tx beams/TRP Rx beam(s)
            - Note: this is not necessarily useful in all cases
        - U-2: is used to enable TRP measurement on different TRP Rx beams to possibly change/select inter/intra-TRP Rx beam(s)
        - U-3: is used to enable TRP measurement on the same TRP Rx beam to change UE Tx beam in the case UE uses beamforming
- FFS Indication of information related to Tx/Rx beam correspondence is supported
- Study UL beam management based on:
    - PRACH
    - SRS
    - DM-RS
    - Other channels and reference signals are not precluded
- Study uplink beam management procedure by considering the Tx/Rx beam correspondence
    - For the case of TRP and UE have Tx/Rx beam correspondence
    - For the case of TRP has no Tx/Rx beam correspondence and/or UE has no Tx/Rx beam correspondence

R1-1610964 WF on Beam recovery Samsung, Qualcomm, Intel, KT, LGE, Ericsson
Also supported by Nokia

Agreements:

- NR supports mechanism(s) in the case of link failure and/or blockage for NR
    - Whether to use new procedure is FFS
- Study at least the following aspects:
    - Whether or not an DL or UL signal transmission for this mechanism is needed
        - E.g., RACH preamble sequence, DL/UL reference signal, control channel, etc.
    - If needed, resource allocation for this mechanisms
        - E.g., RACH resource corresponding mechanism, etc.

R1-1611014 WF on Beam management CATT, CATR, CMCC, Xinwei, Samsung

Not treated.

R1-1608664 High level views on beam management for NR MIMO ZTE, ZTE Microelectronics
R1-1608666 Discussion on beamforming procedure considering high frequency channel characteristics ZTE, ZTE Microelectronics
R1-1608667 Discussion on methods of determining Tx and Rx beams for NR MIMO ZTE, ZTE Microelectronics
R1-1608773 On beam management procedures CATT
R1-1608774 Design of beam training CATT
R1-1608810 Discussion on Paging in NR Fujitsu
R1-1608934 Views on beam management for NR Sony
R1-1609079 Discussion on beam management RS Samsung
R1-1609080 Overview on beam management Samsung
R1-1609081 Discussion on beam recovery Samsung
R1-1609082 Impact of beam/channel reciprocity for NR Samsung
R1-1609083 Discussion on beam switching Samsung
R1-1609247 Views on NR beam management LG Electronics

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R1-1609326	Unified Framework for Beam Management and RRM for NR	MediaTek Inc.
R1-1609379	Discussion on Beam Training Procedure of NR MIMO	Sony
R1-1609408	Discussion on beam management procedure	ITRI
R1-1609414	Discussion on beam management aspects for DL MIMO	Huawei, HiSilicon
R1-1609415	Discussion on beam management aspects for UL MIMO	Huawei, HiSilicon
R1-1609514	Reference Signal and Procedure for UE Beam Refinement (BM P-3)	Intel Corporation
R1-1609515	On network beam switching and refinement (BM P-2)	Intel Corporation
R1-1609516	Beam management for initial and candidate beam discovery (BM P-1)	Intel Corporation
R1-1609517	UL beam management	Intel Corporation
R1-1609691	Beam Management Views and Designs	Beijing Xinwei Telecom Techn.
R1-1609692	Initial Simulation Results of Beam Search	Beijing Xinwei Telecom Techn.
R1-1609878	Beam Management for Control Channel	ZTE, ZTE Microelectronics
R1-1610062	General Views on Beam Management for NR	NTT DOCOMO, INC.
R1-1610063	Discussion on beam management for reciprocity based operation	NTT DOCOMO, INC.
R1-1610145	Beam management for NR	Qualcomm Incorporated
R1-1610239	On beam management in NR - procedures	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610240	Beam managemenet - DCI monitoring	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610241	Beam management - reciprocity issues	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610243	On procedures for beam selection and feedback signalling	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610244	On beam training based on periodic DL signals	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610245	Beam training based on aperiodic DL signals	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610247	Multi-Beam Common Control Plane Design	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610249	Initial results on beam management	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610319	Beam-based design framework for New Radio	INTERDIGITAL COMMUNICATIONS
R1-1610345	Robust and Efficient Beam Management for NR	InterDigital Communications
R1-1610405	DRX and Beam Management	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610437	Beam grouping for beam management	ZTE, ZTE Microelectronics

8.1.4.2 Multi-antenna scheme

High-level MIMO design including Open-loop/Close-loop MIMO, Transmission diversity, SU/MU-MIMO, Multi-TRP transmission

R1-1608809 Over the air calibration for channel reciprocity in NR MIMO Fujitsu

The document was presented by Tsuyoshi Shimomura from Fujitsu.

- Observation 1: Performance of DL multi-point MU-MIMO degrades due to Tx/Rx RF circuit response mismatch at BS in TDD.
- Observation 2: Over the air calibration is necessary to calibrate spatially distributed antennas/TRPs.
- Proposal: Clarify whether intra-BS over the air calibration can be implemented without RAN1 specification.

Decision: The document is noted.

R1-1609519 Discussion on Beamforming for NR PDCCH Intel Corporation

The document was presented by Alexey Khoryaev from Intel.

- Observation 1. Different resource allocation for data and control may cause different beamforming for data and control. In this case, the beamwidth of control channel may be broader than that of data channel. The broad beam is not limited to a physical broad beam but it covers logical broad beam (e.g. multiple beams with different beam pointing angles).
- Observation 2. Different transmission strategy of data and control channel may require different beamforming strategy including different beam directions (or different number of beams).
- Observation 3. At least one beam may be shared by data and control or same beam for data and control may be used.
- Observation 4: A single beam performs better when there is no blockage.
- Observation 5: Multiple beams shows more robust performance when there is blockage on the main path.
- Observation 6: Using multiple beams in control channel provides more flexible beam operation.
- Proposal 1. A default assumption is that data and control channel beamforming is different while using same beam for data and control (at least one beam) is also allowed.
- Proposal 2: Study multiple beam operation in control channel.

Decision: The document is noted.

R1-1609903 Partial reciprocity based UL MIMO schemes InterDigital Communications

The document was presented by … from InterDigital.

- Proposal 1: RAN1 considers study on the effect of interference asymmetry on the use of channel reciprocity for uplink MIMO.
- Proposal 2: RAN1 considers further study on dual precoder design based on combined use of reported- and reciprocity-based CSI for uplink MIMO.

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- Proposal 3: RAN1 considers enhanced uplink MU-MIMO operation by relying on reciprocity-based CSI and intereference feedback.
- Observation 1: Reciprocity-based precoding even with significant calibration errors outperforms codebook based precoding.
- Observation 2: As the dimension of the system grows the gap between the reciprocity-based and ideal CSI-based precoding widens.

Decision: The document is noted.

R1-1610229 Performance comparison of nonlinear precoding schemes for NR MU-MIMO Mitsubishi Electric Co.

The document was presented by … from Mitsubishi.

- Observation 1: Link level evaluation is used to evaluate performance of the nonlinear precoding schemes
- Observation 2: The nonlinear precoding scheme exhibits clear throughput performance gain compared to the linear precoding scheme in crowded environments
- Observation 3: From the CDF of throughput, NLP offers stable throughput in both case A and B, where case A and B are illustrated in Figure 5 and 6, respectively.
- Proposal: Consider nonlinear precoding as a potential spatial multiplexing candidate technology

Decision: The document is noted.

R1-1610484 Way Forward on coordinated transmission schemes in NR LG Electronics, Intel Corporation, Samsung

- At least, followings are supported for coordinated transmission schemes for NR
  - Tx schemes for a single site
    - Intra-site (e.g., across TRPs) coordinated transmission schemes including DPS, CS/CB, and JT
  - Tx schemes for multiple sites with ideal backhaul
    - Inter-site coordinated transmission schemes including DPS, CS/CB, and JT, assuming ideal backhaul links among the coordinating TRPs

Decision: The document is noted. Continue the discussion.

R1-1610380 Discussion on Dynamic Switching of Transmission Modes Convida Wireless LLC

Proposal 1: The NR system should support dynamic switching between transmission modes that does not rely on RRC signaling, and the number of transmission modes should be less than the number of transmission modes in LTE.
Proposal 2: The NR system may support transmission mode configuration through the downlink control channel.
Proposal 3: Beam based transmit diversity should be supported in the NR system, and the single/multiple TRP transmit diversity scheme may be transparent to the UE.
Proposal 4: NR need to evaluate the redundancy caused by designing a unified DCI format to support all transmission modes. The design of UE's search space need to be studied.

Decision: The document is noted.

Wednesday session

R1-1610523 Way Forward on coordination schemes in NR Huawei

R1-1610537 Way Forward on Network Coordination Framework Samsung

- NR network coordination should support different types of network coordination within a common CSI framework
- For NR network coordination, study sufficient level of flexibility in 'reference signal', 'measurement', and 'reporting' settings
  - Allow a network to configure multiple combinations of 'reference signal', 'measurement', and 'reporting' settings
  - Allow a network to independently configure 'reference signal', 'measurement', and 'reporting' settings
  - Allow a network to dynamically and/or semi-statically choose between multiple combinations of 'reference signal', 'measurement', and 'reporting' settings
  - Allow 'reporting' based on actual interference measurement and emulated interference assessment
- Support signaling of QCL information which is linked to 'reference signal' and 'measurement' setting
  - For QCL parameter estimation at least CSI-RS, beam RS, phase noise RS can be considered
    - Other RSs or signals are not precluded
  - The QCL information should support signaling of RS for QCL parameter estimation and the DMRS ports scheduled to a UE where each RS for QCL parameter estimation is mapped to a non-overlapping subset of DMRS ports
- Study the need of information exchanges between gNB-UE for different types of interference suppression (e.g. inter user, inter cell interference) and cancellation based on advanced receivers
  - If needed, the information at least includes side information on interfering UE(s) for efficient interference suppression and cancelation at UE side
  - As a baseline, consider the receivers structures studied in LTE

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Decision: The document is noted.

R1-1610898 WF on coordinated transmission in NR LG Electronics, Huawei, HiSilicon, Samsung

- At least, followings are supported for coordinated transmission schemes for NR
  - Tx schemes for a single site
    - Intra-site (e.g., across TRPs) coordinated transmission schemes including DPS, CS/CB, and JT
  - Tx schemes for multiple sites with ideal backhaul
    - Inter-site coordinated transmission schemes including DPS, CS/CB, and JT, assuming ideal backhaul links among the coordinating TRPs
  - Semi-dynamic configuration of UE-transparent TRP cooperation sets
    - FFS other configurations
    - Study coordination techniques with non-ideal backhaul
  - Note: Non-ideal backhaul has less stringent requirements on synchronization and/or coordination information exchange between geographically separated antenna panels.

Decision: The document is noted.

Agreements:

- For coordinated transmission schemes for NR, both the case of co-located TRPs and the case of non-co-located TRPs are considered
  - FFS the assumptions about latency/bandwidth
  - FFS detailed schemes
  - Note: the classification of co-located vs. non-co-located may not capture all aspects, e.g., synchronization among TRPs, etc.

Agreements:

- For coordinated transmission schemes for NR:
  - Support different types of coordinated transmission schemes for NR
  - Strive for commonality in supporting the different types of coordinated transmission schemes for NR
- Study the need of network assistance and coordination for different types of interference suppression (e.g. inter user, inter-TRP interference) and cancellation based on advanced receivers
  - Consider information related to interfering signals for interference suppression and cancelation at UE side
  - As a baseline, consider NAICs receivers structures in LTE

R1-1610536 Evaluation Assumptions for NR Network Coordination Samsung, Intel, ZTE, ZTE Microelectronics
Further revised in:
R1-1611010 Evaluation Assumptions for NR Network Coordination Samsung, Intel, ZTE, ZTE Microelectronics, Huawei
Decision: R1-1611010 is agreed.
Friday: Huawei commented that the definition of fronthaul remains unclear at this stage – previously agreed R1-1611010 was modified as follows:

Agreements:

- For NR network coordination schemes, following three deployment scenarios are encouraged to be evaluated in phase 1
  - Indoor hotspot, dense urban, urban macro
- Use the simulation assumptions in TR 38.802 as baseline
  - Adopt at least the FeCoMP (TR 36.741) methodology in terms of coordination
    - E.g. Coordination cluster size, backhaul latencies, traffic loads, etc.
  - The parameterization from the agreements on email discussion for NR MIMO calibration [86-20] could be considered

R1-1610893 MIMO transmission based on multiple antenna panels Huawei, HiSilicon, Xinwei, NEC (R1-1610519)
Ericsson→ non-coherent scenario is not needed, nevertheless ok to keep it in the study phase

Agreements:

- Study at least the following different multi-panel structures at both TRP and UE
  - Uniform array: antenna elements with the same polarization from multiple panels are uniformly distributed in horizontal and vertical dimensions respectively (see Fig.1(a) in R1-1610893 as an example)
  - Non-uniform array: antenna elements with same polarization from multiple panels are not uniformly distributed in horizontal or vertical dimension (see Fig.1(b) in R1-1610893 as an example)
- Study the coherent/non-coherent MIMO transmission based on uniform/non-uniform array structure at TRP or UE

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- E.g., Codebook design, calibration accuracy, interference measurement, advanced receiver design, interference hypothesis

R1-1610685 WF on NR UL MIMO CATT, Samsung, LG, InterDigital

Agreements:

- If UE capabilities are known, FFS UL SU-MIMO schemes should be designed agnostic to UE antenna configuration or not
- Support at least a maximum of 4 layers uplink SU-MIMO transmission
  - FFS whether or not to support 5-8 layers

R1-1610983 WF on SRS-based UL link adaptation LG Electronics, CATT, Huawei, HiSilicon, Samsung

Agreements:

- At least one of precoded and non-precoded SRS based UL link adaptation procedure should be supported in NR, with at least following different procedures:
  - UL data scheduling (MCS/precoder/rank) is based on non-precoded SRS transmission by UE
    - Configurable number of SRS ports are 1, 2, 4, or [8]. Other possible numbers FFS.
    - FFS on precoder/codebook
  - UL data scheduling (MCS/precoder/rank) is based on precoded SRS(s) transmission by UE
    - Configurable number of SRS ports are 1, 2, or 4. Other possible numbers FFS.
    - Multiple precoded SRS resources (if supported) can be configured.
    - At least one of the following is supported
      - Precoder for SRS can be determined by UE based on measurement on DL RS and
      - Precoder for SRS can be indicated by gNB
    - FFS on precoder/codebook
  - UL data scheduling (MCS/precoder/rank) is based on a combination of non-precoded and precoded SRS transmission by UE
  - Note: Some parts of above procedures might be transparent to UE
  - FFS: UE may select a subset of SRS ports for SRS transmission

R1-1610694 WF on NR UL MIMO precoding Intel Corporation, NTT DoCoMo, Fujitsu, Samsung
Companies are encouraged to check the examples in R1-1610694, further discussion next meeting

R1-1610486 WF on Spatial Multiplexing Schemes for MU-MIMO Mitsubishi Electric, InterDigital, Samsung
R1-1610831 WF on Spatial Multiplexing Schemes for MU-MIMO Mitsubishi Electric, InterDigital, Samsung, NTT DOCOMO, IITH, IITM, Tejas Networks, CEWIT, KDDI
Also supported by AT&T, Reliance jio, Huawei, HiSilicon

R1-1610895 WF on DL MIMO Transmission Huawei, HiSilicon, CATT

R1-1610633 WF on phase continuity of DL precoding Qualcomm, InterDigital, Xinwei, Huawei, HiSilicon
R1-1611037 WF on phase continuity of DL/UL precoding Qualcomm, Huawei, HiSilicon, Xinwei, Ericsson, ZTE, ZTE Microelectronics, Intel
Also supported by Interdigital

Agreements:

- At least for DL, study PRB bundling with configurable PRG sizes, at least including following aspects
  - The size of PRG may or may not be fixed
  - The size of PRG may or may not be system bandwidth dependent
  - PRG may consist of all scheduled PRBs

R1-1610735 Way Forward on Network Coordination for Advanced Receivers Samsung, Intel, MediaTek, Orange, Vodafone, IITH, Tejas Networks, IITM, KDDI, CeWiT, Reliance Jio
R1-1611047 Way Forward on Network Coordination for Advanced Receivers Samsung, Intel, MediaTek, Orange, Vodafone, IITH, Tejas Networks, IITM, KDDI, CeWiT, Reliance Jio
R1-1611064 Way Forward on Network Coordination for Advanced Receivers Samsung, Intel, MediaTek, AT&T, Orange, Vodafone, IITH, Tejas Networks, IITM, KDDI, CeWiT, Reliance Jio

Agreements:

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- RAN1 to study the following aspects :
  - Codeword-to-layer mapping
  - Number of codewords on a "NR-PDSCH"
  - Other techniques not precluded
- This RAN1 study should consider advanced receivers for interference mitigation
  - In the case of network coordination: the following can also be studied
    - Rank and modulation order
    - Modulation mapping
    - Other techniques not precluded
- FFS: For this RAN1 study, the following performance metrics for non-full-buffer system level evaluation can be considered:
  - Average UPT
  - [5%,50%,95%]-tile UPT

R1-1610967 WF on MIMO transmission techniques in NR LG Electronics, Qualcomm, KT

Agreements:

- DL and UL transmission techniques should be studied to provide robustness against imperfect CSI and mobility
  - e.g.) The techniques using a subset of beams/precoders may include beam cycling, beam broadening, etc.
  - e.g.) In case of DL and FDD, this technical scope may include semi-open-loop MIMO technique being discussed in LTE eFD-MIMO.

R1-1611044 WF on DL MIMO Transmission Huawei, HiSilicon, Ericsson, CATT

Agreements:

- Support downlink transmission scheme(s) achieving diversity gain at least for some control information transmission
  - Exact scheme is for further study.
  - Specification support for such transmission schemes, i.e., the scheme(s) may or may not be implemented in spec-transparent manner
  - Note: The data/control channel transmission is at least based on DM-RS for demodulation.

Not treated.

R1-1608668	Discussion on interference issues in NR	ZTE, ZTE Microelectronics
R1-1608669	Discussion on UL MIMO transmission for NR	ZTE, ZTE Microelectronics
R1-1608670	Discussion on DL MIMO transmission for NR	ZTE, ZTE Microelectronics
R1-1608775	MIMO transmission schemes for NR	CATT
R1-1608776	Discussion on UL MIMO for NR	CATT
R1-1608819	Discussion on DL MIMO transmission	Huawei, HiSilicon
R1-1608820	Discussion on UL MIMO transmission	Huawei, HiSilicon
R1-1608851	Antenna Structure Impacts on MIMO transmission and codebook design	Huawei, HiSilicon
R1-1608905	Discussion on Multi-antenna Scheme	Guangdong OPPO Mobile Telecom.
R1-1609084	DMRS-based spatial multiplexing for DL NR MIMO	Samsung
R1-1609085	DMRS-based spatial multiplexing for UL NR MIMO	Samsung
R1-1609086	Discussion on transmission schemes, transmission modes and control signaling	Samsung
R1-1609101	Discussions on NR network coordination	Samsung
R1-1609102	Evaluation assumptions for NR network coordination	Samsung
R1-1609103	Coordinated interference cancellation for NR	Samsung
R1-1609104	Evaluation assumptions for NR coordinated interference cancellation based on advanced receivers	Samsung
R1-1609249	Views on NR DL MIMO	LG Electronics
R1-1609250	Views on NR UL MIMO	LG Electronics
R1-1609251	Discussion on semi-OL MIMO for NR	LG Electronics
R1-1609252	Discussion on interference management for NR	LG Electronics
R1-1609305	Updated System Level Evaluation for NR MIMO	CMCC
R1-1609306	General Requirements on NR MIMO	CMCC
R1-1609417	Overview of coordination schemes and interference management techniques in NR	Huawei, HiSilicon
R1-1609518	Discussion on NR MIMO Transmission Schemes and Transmission Modes	Intel Corporation
R1-1609520	UL subband precoding for NR	Intel Corporation
R1-1609693	Views on NR MIMO Transmission Schemes	Beijing Xinwei Telecom Techn.
R1-1609755	On codewords and layer mapping	Ericsson
R1-1609756	On NR MIMO below 6 GHz	Ericsson
R1-1609905	MIMO transmission schemes for NR	InterDigital Communications

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R1-1610064 Hybrid Beamforming for NR NTT DOCOMO, INC.
R1-1610065 High order MU-MIMO with TDD channel reciprocity NTT DOCOMO, INC.
R1-1610066 Discussion on frequency selective precoding for Uplink MIMO transmission NTT DOCOMO, INC.
R1-1610095 Discussion on DL multi-antenna transmission schemes CHTTL
R1-1610146 Continuous beamforming and initial evluation results Qualcomm Incorporated
R1-1610147 DL open-loop MIMO transmission schemes Qualcomm Incorporated
R1-1610148 Uplink MIMO transmission schemes Qualcomm Incorporated
R1-1610227 Nonlinear precoding schemes for NR MU-MIMO and their specification impact Mitsubishi Electric Co.
R1-1610250 Scalability of MIMO operation across NR carrier frequencies Nokia, Alcatel-Lucent Shanghai Bell
R1-1610251 On simultaneous reception of single-beam and multi-beam uplink Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-1610252 Unified MIMO transmission mode for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610253 Decoupled Control and Data for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610254 High-level principles for beam coordination and Link Adaptation in NRNokia, Alcatel-Lucent Shanghai Bell
R1-1610255 Non-coherent Multi-node Transmission for URLLC in the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1610256 On the support of transmit diversity in NR for data and control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1610257 UL MIMO transmission in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610259 SU-MIMO Performance Characteristics in UMa 30GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-1610260 MU-MIMO Performance Characteristics in UMa 30GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-1610261 Uplink SU-MIMO Performance Characteristics in 5G-UMa 4GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-1610262 Coverage Enhancement Opportunities at High Carrier Frequencies Nokia, Alcatel-Lucent Shanghai Bell
R1-1610263 Network Coordination to support advanced receivers Nokia, Alcatel-Lucent Shanghai Bell
R1-1610721 Way Forward on UL link adaptation procedures in NR LG Electronics

8.1.4.3 CSI acquisition

R1-1609254 Discussion on interference measurement for NR LG Electronics

The document was presented by … from LGE.

- Observation 1: IMR based interference power measurement seems to be still preferable in NR. Interference channel estimation approach can also be considered and may have benefit in the case of large number of interference hypotheses but with small number of antenna ports.
- Observation 2: Interference feedback methods seems to be needed for multiple interference hypotheses in NR. Required amount of feedback and CSI computation should however be taken into account.
- Proposal 1: Inter-beam, MU, and inter-TRP interference should be considered in NR
- Proposal 2: Interference measurement structure is desired to be agnostic to interference type.
- Proposal 3: Consider aperiodic/periodic/semi-persistent resource for interference measurement.
- Proposal 4: Consider independent configuration of resources/signals for interference measurement and CSI measurement.

Decision: The document is noted.

R1-1609694 Views on NR CSI Acquisition and Report Beijing Xinwei Telecom Techn.

The document was presented by Peng Sun from Xinwei.

- Proposal 1: NR MIMO CSI measurement and report framework could be based on the framework of FD-MIMO CSI measurement and report, with refinement on beam combination codebook design, CoMP and streamlining of transmission modes and CSI report classes.
- Proposal 2:CSI report in NR MIMO framework mainly consists of beam index,PMI, RI, CQI and a novel index indicating whether or which TRPs could be used for simultaneous transmission .
- Proposal 3: Without legacy design, with fewer reporting modes, and with higher uplink control payload ability, NR should avoid the many kinds of UCI reports in LTE.
- Proposal 4: Nested property and constant modulus is still the design principle of beam combination codebook. Householder codebook is a good starting point.
- Proposal 5: NR MIMO supports in UCI novel index of whether or which TRPs in the large amount of candidates could be selected for simultaneous transmission.
- Proposal 6: For NR TDD, beam information related to analog beam selection is still acquired from DL beam training reference signal. For beam combination and multiple TRP cooperation, channel reciprocity could be triggered.
- Proposal 7: All UL CSI is acquired through measurement of dynamically configured and triggered SRS. It is possible for UE to transmit multiple SRS simultaneously through different panels/TxRUs. Multiple TRPs should be able to receive the same SRS simultaneously.

Decision: The document is noted.

R1-1610265 Explicit feedback options in NR Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by Mihai Enescu from Nokia.

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- Proposal 1: Study the use of high resolution CSI feedback for operation with a hybrid array (i.e., a relatively few ports used in the data transmission) and for operation with a full digital array (i.e., relatively large number of ports used in the data transmission).
- Proposal 2: Study the various mechanisms for high resolution CSI feedback and explore the tradeoffs in performance and required level of feedback.

Decision: The document is noted.

R1-1610517 Way Forward on CSI measurement and reporting Huawei, HiSilicon, Ericsson, Qualcomm

- Support explicit CSI feedback in NR
  - e.g. channel covariance matrix feedback, eigenvector feedback, etc.
- Support the following schemes of NR CSI reporting
  - Semi-persistent CSI reporting
  - Aperiodic CSI reporting
  - FFS: Periodic CSI reporting
- The feasibility of CSI-RS transmission and CSI reporting in a self-contained structure (e.g., subframe) should be studied, considering UE implementation complexity.
  - Possible constraints: CSI reporting includes CQI and/or interference level only
- Interference measurement under different interference hypothesis should be supported in NR.
  - Note: analogous to CSI-IM and interference hypothesis in LTE
- Interference measurement based on a hybrid of ZP CSI-RS and NZP CSI-RS should be studied.

Decision: The document is noted.

R1-1610509 Way Forward on CSI-RS and CSI reporting in NR LG Electronics, Ericsson, Intel

- NR supports CSI-RS at least for CSI measurement and reporting.
  - FFS: Use of DL DMRS for CSI measurement and reporting
- NR supports both aperiodic and semi-persistent transmission of CSI-RS.
  - FFS: periodic transmission of CSI-RS
    - Note: periodic RS means 'always-on' RS analogous to LTE CRS
  - FFS: mechanisms (e.g. protocol layer) for dynamic control of activation/deactivation for semi-persistent CSI-RS
  - FFS: mechanisms to provide reliable activation/deactivation for semi-persistent CSI-RS
- With regard to relating CSI-RS transmission and CSI reporting, following combinations are supported at least.
  - Aperiodic CSI reporting with aperiodic CSI-RS
  - Aperiodic CSI reporting with semi-persistent CSI-RS
  - Semi-persistent CSI reporting with semi-persistent CSI-RS
- To support combinations above more flexibly, NR should allow independent control of CSI-RS indication and CSI reporting indication.
  - 'indication' above may refer to triggering, activation, and deactivation depending on type of RS/reporting.
  - Further study is needed how to guarantee appropriate time gap between CSI-RS and CSI reporting.
  - Note: This does not preclude joint control of CSI-RS indication and CSI reporting indication.

Decision: The document is noted.

R1-1610515 Way Forward on CSI reporting for NR Samsung, Intel, Ericsson, Xinwei

- Support aperiodic CSI reporting for NR
- Support at least one of following CSI reporting schemes for NR:
  - Periodic CSI reporting
  - Semi-persistent CSI reporting
- Study periodic/semi-persistent CSI reporting by using other signals than CSI-RS
  - FFS on necessary configurations, conditions, situations and use cases

Decision: The document is noted.

Tuesday session

R1-1610716 Way Forward on CSI-RS and CSI reporting in NR LG Electronics, Ericsson, Intel, Samsung

Decision: The document is noted, modified and agreed as follows:

Agreements:

- At least for CSI acquisition, NR supports CSI-RS, SRS
  - FFS: Use of DL DMRS for CSI measurement
- NR supports aperiodic transmission of CSI-RS
- For CSI-RS transmission, NR supports at least one of following:
  - Semi-persistent transmission

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        - Preconfigured CSI-RS resources can be activated or de-activated
        - FFS: Activation/De-activation mechanism
    - Periodic transmission
        - Periodic CSI-RS can be configured by higher layer
    - FFS: mechanisms (e.g. protocol layer) for dynamic control of activation/deactivation for semi-persistent CSI-RS
    - FFS: mechanisms to provide reliable activation/deactivation for semi-persistent CSI-RS
- NR supports aperiodic CSI reporting
- NR supports at least one of following:
    - Periodic CSI reporting
        - It can be configured by higher layer
    - Semi-persistent CSI reporting
        - Configuration of CSI reporting can be activated or de-activated
        - FFS: Activation and de-activation mechanism
- Study periodic/aperiodic/semi-persistent CSI reporting by using CSI-RS
    - FFS using other RSs
    - FFS on necessary configurations, conditions, situations and use cases
- With regard to relating CSI-RS transmission and CSI reporting, following combinations are supported at least
    - Aperiodic CSI reporting with aperiodic CSI-RS
    - Aperiodic CSI reporting with semi-persistent/periodic CSI-RS
    - Semi-persistent/periodic CSI reporting with semi-persistent/periodic CSI-RS
- To support combinations above more flexibly, NR should allow independent control of CSI-RS indication and CSI reporting indication timings.
    - 'indication' above may refer to triggering, activation, and deactivation depending on type of RS/reporting.
    - Further study is needed how to guarantee appropriate time gap between indication of CSI-RS transmission and CSI-RS
    - Further study is needed how to guarantee appropriate time gap between CSI-RS and CSI reporting
    - Note: This does not preclude joint control of CSI-RS indication and CSI reporting indication.

Wednesday session

R1-1610637 Way Forward on CSI Framework for NR Samsung, Ericsson, AT&T, KT Corporation, CATT (R1-1610533)

- CSI-related settings consisting of:
    - CSI reporting settings
        - Each CSI parameter is independently configured, e.g. time and/or frequency granularity, ON/OFF
            - FFS: Details of configurability
        - CSI parameters include at least RI, PMI, CQI, and CSI-RS resource indicator (CRI)
    - RS (at least for CSI measurement) settings, e.g. CSI-RS (CSI-IM as a special case)
        - FFS: Other RS for CSI measurement
    - CSI measurement settings
        - To configure which RS setting is used for a particular CSI reporting setting
- A UE can be configured with:
    - *N* CSI reporting settings
    - *M* RS (for CSI measurement) settings
    - CSI measurement setting configures mapping/linkage between *N* CSI reporting and *M* RS settings
- Transmission scheme is configured separately
    - Examples of transmission scheme: DMRS-based precoding, Tx diversity, …
    - Examples of use case for study:
    - Linking/combining multiple PMI components (e.g. i1, i2 in LTE) with multiple RS settings

Decision: The document is noted, modified as follows:

Agreements:

- CSI-related settings consisting of:
    - CSI reporting settings
        - CSI parameter can be independently configured, e.g. time and/or frequency granularity, FFS: ON/OFF
            - FFS: Details of configurability
        - Definition of CSI parameters (e.g., CQI, PMI, RI) is FFS
    - RS (at least for CSI measurement) settings, e.g. CSI-RS (CSI-IM as a special case)
        - FFS: Other RS for CSI measurement
    - CSI measurement settings
        - To configure which RS setting is used for a particular CSI reporting setting
- Study the case where a UE can be configured with:

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- *N* CSI reporting settings
- *M* RS (for CSI measurement) settings
- CSI measurement setting configures mapping/linkage between *N* CSI reporting and *M* RS settings

R1-1610638 Way Forward on PMI Reporting for NR Samsung, AT&T, Ericsson, NTT DOCOMO (R1-1610534)

- NR CSI reporting supports PMI with two levels of spatial resolution:
  - Normal-resolution, e.g. analogous to LTE PMI ("implicit" feedback)
  - High-resolution, e.g. quantized channel, eigenvector, or covariance matrix
  - PMI per subband as well as wideband PMI is supported
- The supported PMI associated with each of the two levels is derived from a codebook
  - Working assumption: The codebook is scalable with different numbers of CSI-RS ports (including at least the ones supported in LTE Rel.14)
- Study at least the following codebook design aspects:
  - "Dual-stage" PMI definition analogous to i1 and i2 in LTE, e.g.
    - Precoder basis associated with i1
    - Precoder selection and/or combining associated with i2
    - Frequency granularity of i1 and i2 (e.g. wideband, subband, subband size)
  - "Multi-stage" feedback analogous to i1 and i2 in LTE but with more stages
    - The overall precoder being a function of the feedback for each of these stages
  - Unified and scalable design for both normal- and high-resolutions

Decision: The document is noted, modified as follows:

Possible agreements:

- NR supports CSI reporting with two types of spatial information feedback
  - Type I feedback
  - Type II feedback
    - Note: Type II feedback is higher resolution compared to Type I feedback
- For Type I and II, CSI feedback per subband as well as wideband feedback are supported
- Type I and II are designed for different use cases and/or functionalities
  - Only one scheme is supported for Type I
  - Only one scheme is supported for Type II
- Study following design examples as candidates for Type I
  - PMI-based scheme analogous to LTE Rel-13/14 beam selection codebook ("implicit" feedback) including CRI based feedback
  - Other schemes are not precluded
- Study following design examples as candidates for Type II:
  - PMI-based scheme using beam combination codebook
  - "Explicit" feedback such as quantized channel, channel eigenvector(s) or channel covariance matrix, analog feedback
  - Other schemes are not precluded
- Also study the following design examples:
  - "Dual-stage" PMI definition analogous to i1 and i2 in LTE, e.g.
    - Precoder basis associated with i1
    - Precoder selection and/or combining associated with i2
    - Frequency granularity of i1 and i2 (e.g. wideband, subband, subband size)
  - "Multi-stage" feedback analogous to i1 and i2 in LTE but with more stages
    - The overall precoder being a function of the feedback for each of these stages
  - Beam broadening function
  - Hermitian matrix based covariance matrix codebook
  - Downloadable codebook
  - Other designs are not precluded

Agreements:

- NR supports CSI reporting with two types of spatial information feedback
  - Type I feedback: Normal
  - Codebook-based PMI feedback with normal spatial resolution
  - Type II feedback: Enhanced
  - "Explicit" feedback and/or codebook-based feedback with higher spatial resolution

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- For Type I and II, CSI feedback per subband as well as wideband feedback are supported
- For Type I and II, beam-related feedback can be included

R1-1610907 WF on CSI-RS resource pooling Ericsson, Samsung, LG, Nokia (R1-1610705)

- A CSI-RS resource set should be supported whereby CSI-RS resources within the set may be dynamically shared amongst users
- CSI-RS resources are configured in 2 steps
  - Step 1: Pre-configure a set of K CSI-RS resources for a group of users through RRC configuration
  - Step 2: For a given user, dynamically indicate N out of K (where N >= 1) of the CSI-RS resources from the set to enable CSI measurement in a given time window
    - Study the following alternatives
      - Alt 1: Dynamic signaling through DCI
      - Alt 2: Dynamic signaling through MAC CE
  - The CSI-RS transmissions can be dynamically indicated as one shot or multi-shot within the window

Decision: The document is noted, modified as follows:

Agreements:

- A CSI-RS resource set should be studied whereby CSI-RS resources within the set may be dynamically shared amongst users
- Study CSI-RS resources configuration in 2 steps
  - Step 1: Pre-configure a set of K CSI-RS resources for one or more users through UE-specific RRC configuration
  - Step 2: For a given user, dynamically indicate N out of K (where N >= 1) of the CSI-RS resources from the set to enable CSI measurement in a given time window
    - Study the following alternatives
      - Alt 1: Dynamic signaling through DCI
      - Alt 2: Dynamic signaling through MAC CE
  - The CSI-RS transmissions can be dynamically indicated as one shot or multi-shot within the window
  - The configured CSI-RS resource pool can be used for channel/interference measurement
  - Configure multi sets of CSI-RS resources for one UE

R1-1610517 Way Forward on CSI measurement and reporting Huawei, HiSilicon, Ericsson, Qualcomm

Agreements:

- The feasibility of CSI-RS transmission and CSI reporting in a self-contained structure (e.g., subframe) should be studied, considering UE implementation complexity
  - FFS: DM-RS based CSI reporting
- Interference measurement under different interference hypothesis should be supported in NR
  - Definition of interference hypothesis and mechanism of interference measurement is FFS

R1-1610899 Way Forward on CSI feedback framework for hybrid beamforming in NR CMCC, CATT, Xinwei, Samsung, Ericsson, Huawei, HiSilicon, Qualcomm (R1-1610727)

- For hybrid beamforming, at least the following steps for CSI/RSRP acquisition should be studied:
  - Step 1: Beam-based CSI/ and/or RSRP (e.g., based on beam management procedures)
    - To determine at least analog beam
    - Using UE feedback and/or beam-based reciprocity
      - With beam-based reciprocity, TRP/UE can obtain DL/UL Tx beam from its Rx beam by multi-beam reception
  - Step 2: Port-based CSI
    - To determine the precoder for all or part of TXRUs (narrow digital beam) given the reported analog beam
    - Using UE feedback and/or port-based reciprocity
      - With port-based reciprocity, TRP/UE can obtain DL/UL CSI based on UL SRS/DL RS
  - Step 3: CQI
    - To determine CQI for data transmission given the reported analog and digital beam
    - Based on UE-specific beamformed CSI-RS transmission
  - Further optimization of the procedure for reciprocity/non-reciprocity can be considered
  - Note: Certain steps may be merged/reordered/repeated
- Study the association between UL and DL RS in/among the above steps:
  - E.g. When channel reciprocity holds, UL/DL RS port/resource may be selected/precoded based on DL/UL RS measurement results

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- CSI/RSRP acquisition or full digital or full analog beamforming can be a special case of the above framework
  - For single-beam based approach, step 1 doesn't apply

Decision: The document is noted, modified as follows:

Agreements:

- For hybrid beamforming, at least the following steps for CSI/RSRP acquisition should be studied:
  - Step 1: Beam-based CSI/ and/or RSRP (e.g., based on beam management procedures)
    - To determine at least analog beam
      - Using UE feedback and/or beam-based reciprocity
      - With beam-based reciprocity, TRP/UE can obtain DL/UL Tx beam from its Rx beam by multi-beam reception
  - Step 2: Port-based CSI
    - To determine the precoder for digital beam based on the reported analog beam(s)
      - Using UE feedback and/or port-based reciprocity
      - With port-based reciprocity, TRP/UE can obtain DL/UL CSI based on UL SRS/DL RS
  - Step 3: CQI
    - To determine CQI for data transmission given the reported analog and digital beam
    - Based on UE-specific CSI-RS transmission
  - Further optimization of the procedure for reciprocity/non-reciprocity can be considered
  - Note: Certain steps may be merged/reordered/repeated
- Study the association between UL and DL RS in/among the above steps
- Note: CSI/RSRP acquisition for full digital or full analog beamforming can be a special case of the above framework
  - For single-beam based approach, step 1 may not apply

R1-1610906 WF on channel and interference measurements for NR Samsung, Intel, Qualcomm

Agreements:

- For channel and interference measurement in NR,
  - For interference measurement, support at least one of following schemes:
    - Measurement subsets in both time and frequency domain
    - Interference measurement restriction in both time and frequency domain
    - FFS on channel measurement
    - FFS on the details (including whether measurement subset is equivalent to measurement restriction in the freq. domain)
  - Study CSI reporting which is optimized for each use case
    - E.g. CQI which is targeted to high reliability

R1-1610950 WF on interference measurement for CSI acquisition Qualcomm, Huawei, HiSilicon, Samsung

Agreements:

- For DL data transmission, study following interference measurement options for CSI acquisition.
  - Dynamically assigned (e.g., pre-committed/pre-scheduled) interference measurement resource
  - In-scheduled interference measurement resource
  - NZP CSI-RS based interference measurement
  - DM-RS based interference measurement
  - Combination of above options
  - Other options are not precluded
- Above study should assume non-full buffer traffic model assumption

R1-1610937 WF on CSI Parameters for NR Samsung, Nokia, ASB, AT&T, CATT, NTT DOCOMO, Ericsson, Intel, LG Electronics, InterDigital

Agreements:

- For Type I feedback, NR supports at least the following (DL) CSI reporting parameters
  - Resource selection indicator (Examples for further study are reference signal resource, port, reference signal sequence, beam)
  - RI (rank indicator)
  - PMI (precoding matrix indicator)
  - Channel quality feedback

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Not treated.

R1-1608671	Beam selection and CSI acquisition for NR MIMO	ZTE, ZTE Microelectronics
R1-1608672	Advanced CSI measurement and reporting framework for NR MIMO	ZTE, ZTE Microelectronics
R1-1608693	Aperiodic CSI for NR MIMO	ZTE, ZTE Microelectronics
R1-1608777	High-level views on CSI acquisition for NR	CATT
R1-1608811	Discussion on CSI Acquisition for Massive MIMO in NR	Fujitsu
R1-1608949	CSI feedback for channel reciprocity operation	Sony
R1-1609087	CSI acquisition for DL NR MIMO	Samsung
R1-1609088	CSI acquisition for UL NR MIMO	Samsung
R1-1609089	Advanced CSI feedback for NR	Samsung
R1-1609090	Simulation results for explicit CSI reporting for NR MIMO	Samsung
R1-1609091	Discussions on periodic CSI reporting for NR	Samsung
R1-1609092	Discussions on aperiodic CSI reporting for NR	Samsung
R1-1609093	Discussions on channel and interference measurements for NR	Samsung
R1-1609253	Views on CSI acquisition for NR	LG Electronics
R1-1609255	Discussion on channel reciprocity for NR MIMO	LG Electronics
R1-1609307	Considerations on DL CSI acquisition framework of massive MIMO for new radio	CMCC
R1-1609380	Massive MIMO: Channel State Information (CSI) Acquisition in Angular Domain	Sony
R1-1609416	Discussion on CSI measurement and reporting	Huawei, HiSilicon
R1-1609521	Discussion on NR CSI framework	Intel Corporation
R1-1609522	Discussion on NR CSI configuration	Intel Corporation
R1-1609523	Discussion on NR CSI contents	Intel Corporation
R1-1609758	Overview of CSI framework for NR	Ericsson
R1-1609760	Decoupled CSI framework for NR	Ericsson
R1-1609761	Details on the unified CSI framework for NR	Ericsson
R1-1609762	Port combining codebook for NR	Ericsson
R1-1609763	Aperiodic CSI and CSI-RS resource pooling	Ericsson
R1-1609906	CSI acquisition for NR MIMO	InterDigital Communications
R1-1609907	Consideration of Short Block-length for CQI Feedback for NR	InterDigital Communications
R1-1610067	CSI Acquisition Schemes for NR	NTT DOCOMO, INC.
R1-1610068	Codebook design requirement for NR	NTT DOCOMO, INC.
R1-1610069	Discussion on CSI acquisition scheme for Uplink MIMO transmission	NTT DOCOMO, INC.
R1-1610149	Discussion on CSI acquisition	Qualcomm Incorporated
R1-1610150	Beam reciprocity aspects	Qualcomm Incorporated
R1-1610264	CSI feedback types in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610266	On the CSI reporting in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610267	On the CSI timing relationhips	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610268	On the channel and interference estimation in NR	Nokia, Alcatel-Lucent Shanghai Bell

8.1.4.4 Reference signal design and QCL

R1-1608675 On Quasi-Co-Location/Beam for NR MIMO ZTE, ZTE Microelectronics

The document was presented by Ruyue Li from ZTE.

- Observation 1: Delay offset among different beam-based channel is significant.
- Observation 2: Similar channel properties can be observed when the beam-pairs point to the adjacent direction.
- Proposal 1: Introducing a new set of "Qusai-Co-beam" parameters e.g. angle of arrival, angular spread to QCL parameters. Grouping of antenna ports according to quasi-co-beam properties is fed back by the UE.
- Proposal 2: Support flexible configuration of the QCL parameters for different applications
- Proposal 3: Support QCL association of UL ports to DL ports considering channel reciprocity

Decision: The document is noted.

R1-1608822 Reference signal design for phase noise compensation in HF Huawei, HiSilicon

The document was presented by … from Huawei.

Observation 1: Phase noise compensation is needed in certain scenarios, depending on at least the scheduled MCS and number of RBs.

Observation 2: Whether the reference signal carrying phase noise compensation functionality is UE-specific or non-UE-specific needs to be studied.

Observation 3: The methods of multiplexing multiple reference signals enabling phase noise compensation for multiple users/streams needs to be studied, including at least FDM and CDM methods.

Observation 4: To reduce overhead and complexity, potential sharing of reference signal for phase noise compensation across streams should be studied.

Proposal 1: The reference signal design in NR should facilitate phase noise compensation when it is needed, especially for frequency bands above 6 GHz.

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Proposal 2: The reference signal in NR carrying the phase noise compensation functionality should be continuously mapped in the time domain, i.e., on each data symbol.
Proposal 3: NR should be able to configure the reference signal carrying phase noise compensation functionality (e.g., to map or not), independent of front-loaded RS.

Decision: The document is noted.

R1-1609261 Discussion on Common Phase Error Compensation for Above 6GHz LG Electronics

The document was presented by … from LGE.

- Observation 1: BLER performance gap according to PTRS frequency density is much higher as TRB size is larger.
- Observation 2: 4 or 8 PTRS is enough for CPE estimation regardless of # of TRB.
- Observation 3: BLER performance gap according to PTRS time density is much higher as TRB size is larger.
- Observation 4: For 4 TRBs, non CPE compensation has better spectral efficiency than CPE compensation.
- Observation 5: For 64 TRBs, CPE compensation except for 1 PTRS has better spectral efficiency than non CPE compensation.
- Observation 6: For 4 TRBs, PTRS time interval 2 achieves higher spectral efficiency than time interval 1. In contrast, for 64 TRBs, PTRS time interval 1 achieves higher spectral efficiency than time interval 2.
- Observation 7: Codeblock spreading in the time domain reduces phase noise impact even for CPE compensation.
- Proposal 1: The trade-off between performance gain from CPE compensation and PTRS overhead should be considered.
- Proposal 2: PTRS time interval should be designed flexibly according to TRB size.
- Proposal 3: Codeblock spreading in the time domain would be considered.

Decision: The document is noted.

R1-1609388 Generalized CSI feedback framework for NR MIMO AT&T GNS Belgium SPRL

The document was presented by Arun Ghosh from AT&T.

- Proposal 1: No need to define transmission mode in NR MIMO. Instead, allow configuration on transmission scheme, RS and CSI measurement/report and downlink control format separately.
- Proposal 2: If needed, dependency or coupling between functions can be introduced during the configurations procedure.
- Proposal 3: The NR CSI feedback framework should support codebook based CSI plus at least one advanced CSI feedback scheme.
- Proposal 4: The NR CSI feedback framework should describe MIMO channel by multiple CSI components, we suggest to describe channel using components in Horizontal, Vertical and Uncorrelated domain separately.
- Proposal 5: The CSI measurement for each CSI component can be based on independent configured CSI-RS.
- Proposal 6: Both network and UE should be involved in deciding the feedback payload bits and CSI granularity (frequency, time, spatial domain) for each CSI component.
- Proposal 7: Study the need of CSI feedback for control channel, and if needed, strive for one generic CSI feedback framework to support both data and control channel.

Decision: The document is noted.

R1-1610524 Way Forward on NR RS definition Huawei, HiSilicon

- The following RSs are supported for NR downlink
  - NR DL CSI-RS: a family of reference signals with main functionalities of CSI acquisition, beam management, and RRM measurement
  - NR DL DM-RS: a family of reference signals with main functionalities of data and control demodulation;
    - FFS: additional reference signal for phase tracking;
- The following RSs are introduced for NR uplink
  - NR UL SRS: a family of reference signals with main functionalities of CSI acquisition, beam management, and RRM measurement;
  - NR UL DM-RS: a family of reference signals with main functionalities of data and control demodulation;
    - FFS: additional reference signal for phase tracking;

Decision: The document is noted. Continue offline.

Agreements:

- At least the following RSs are supported for NR downlink
  - CSI-RS: Reference signal with main functionalities of CSI acquisition, beam management
    - FFS: RRM measurement
  - DM-RS: Reference signal with main functionalities of data and control demodulation
    - FFS: channel state information estimation and interference estimation
    - FFS: beam management
  - Reference signal for phase tracking
    - FFS: Whether DM-RS extension can be applied or not
    - FFS whether new RS or RS for other functionalities can be used
  - Reference signal for time/freq. tracking

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        - FFS whether new RS or RS for other functionalities can be used
    - Reference signal for Radio link monitoring
        - FFS whether new RS or RS for other functionalities can be used
    - RS for RRM measurement
        - FFS whether new RS or RS for other functionalities can be used
- At least the following RSs are supported for NR uplink
    - SRS: Reference signal with main functionalities of CSI acquisition, beam management
        - FFS: RRM measurement
    - DM-RS: Reference signal with main functionalities of data and control demodulation
        - FFS: beam management
    - Reference signal for phase tracking
        - FFS: Whether DM-RS extension can be applied or not
        - FFS whether new RS or RS for other functionalities can be used
    - FFS: Reference signal for RRM measurement
        - FFS whether new RS or RS for other functionalities can be used

R1-1610490 Way Forward on NR CSI-RS Huawei, HiSilicon

- Support the following functionalities in NR CSI-RS design
    - CSI measurement
    - Beam measurement
    - RRM measurement
- Support NR CSI-RS pattern with at least the following properties:
    - CSI-RS mapped in one or multiple consecutive symbols
    - At least CSI-RS located at the earlier part of a slot
        - FFS: before or after the DM RS agreed to study in RAN1#85
    - FFS: CSI-RS located at other part of a slot
    - Configurable density of CSI-RS in frequency domain
    - FFS: CSI-RS for NR should support up to at least 32 ports
- Support at least following configurations of NR CSI-RS
    - UE-specific configuration to support
        - Wideband CSI-RS, i.e. the full bandwidth the UE is configured to operate with
        - Subband CSI-RS, i.e. part of the bandwidth the UE is configured to operate with

Decision: The document is noted, modified as follows:

Agreements:

- Support NR CSI-RS pattern with at least the following properties:
    - CSI-RS mapped in one or multiple [consecutive] symbols
    - FFS: At least CSI-RS located at the earlier part of a slot in some cases
        - FFS: before or after the DM-RS agreed to study in RAN1#85
    - FFS: CSI-RS located at other part of a slot
    - Working assumption: Configurable density of CSI-RS in frequency and/or time domain by UE-specific manner
    - Working assumption: CSI-RS for NR should support up to 32 ports
        - FFS: whether or not to have 32 ports codebook
- Support at least following configurations of NR CSI-RS
    - UE-specific configuration to support
        - Wideband CSI-RS, i.e. from UE perspective, the full bandwidth the UE is configured to operate with
        - Partial-band CSI-RS, i.e. from UE perspective, part of the bandwidth the UE is configured to operate with
        - FFS: Different patterns may be used for wideband and subband CSI-RSs

R1-1610492 Way Forward on the CSI-RS configuration for NR Intel, Samsung, Ericsson

- CSI-RS configuration for NR includes at least 'number of antenna ports'
- The number of CSI-RS antenna ports can be differently configured for periodic/semi-persistent CSI reporting and aperiodic CSI reporting
- The number of antenna ports supported for CSI-RS configuration includes at least the following values
    - 1,2,4,8,12,16,20,24,28,32

Decision: The document is noted.

Agreements:

- CSI-RS configuration for NR includes at least 'number of antenna ports'
    - Configuration can be explicit or impliit

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- The number of CSI-RS antenna ports can be independently configured for periodic/semi-persistent CSI reporting and aperiodic CSI reporting

Possible working assumption:
- The number of antenna ports supported for CSI-RS configuration includes at least the following values
  - 1,2,4,8,12,16,20,24,28,32

Continue offline discussion until Thursday

Thursday

Working assumption:
- The number of antenna ports supported for CSI-RS configuration includes at least the following values
  - 1,2,4,8,[12],16,[20],[24],[28],32
- RAN1 will update/remove above bracket parts in the next meeting
  - Study e.g., performance, scenario, RS overhead, RS pattern considering the frame structure, reuse of hardware between NR and LTE

R1-1610514 Way Forward on Reference Signal for Demodulation ZTE Corporation, ZTE Microelectronics
- Support variable/configurable RS pattern for demodulation
  - For both control and data channel
- Study multi-level RS for demodulation
  - The first level is front-loaded (i.e. loaded in the front of RB) which meets minimum requirements for demodulation
  - Other level(s) can be configured for different motivations, e.g. higher frequency/time density, Rx beam detection, RSRP/CSI-reporting, phase noise compensation

Decision: The document is noted. Also supported by Ericsson, Samsung

Possible agreements:
- Support variable/configurable RS pattern for demodulation
  - For data channel
  - FFS for control channel
  - At least density can be configured
    - FFS: other configurability
- Support multi-level RS for demodulation
  - The first level is front-loaded (i.e. loaded in the front of RB) which meets minimum requirements for demodulation
  - Other level(s) can be configured for different motivations, e.g. higher frequency/time density, Rx beam detection, RSRP/CSI-reporting, phase noise compensation

Continue offline discussion until Wednesday

Agreements:
- Study variable/configurable DL/UL RS pattern for demodulation
  - For data channel and control channel
  - At least density can be configurable
    - FFS: other configurability
  - The applicable scenarios need to be studied
- Study multi-set DL/UL RS for control and/or data demodulation
  - The first set is front-loaded (i.e. loaded in the front of RB)
  - Other set(s) can be configured for different purposes
    - Details FFS (e.g. higher frequency/time density, Rx beam detection, RSRP/CSI-reporting, phase noise compensation)

R1-1610491 Way Forward on NR DMRS Huawei, HiSilicon
- Separate design of demodulation RS for broadcast channel, control channel and data channel
- Studies on design of demodulation RS for data channel at least include
  - The same principle for UL and DL RS pattern design
  - DM RS mapped in one or a few consecutive symbols
  - Additional RS located at middle part of a slot
  - Up to 16 orthogonal DL DMRS ports for MU-MIMO scheduling

Discussion: Chair→ strive for more supporting companies

Decision: The document is noted.

Agreements:
- Study design of demodulation RS for broadcast channel, control channel and data channel

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  - Separate vs. joint design
- Study on design of demodulation RS for data channel
  - Whether or not the same principle for UL and DL RS pattern design
  - How to map DM RS in symbols of a slot
  - Max # of orthogonal DL DMRS ports for SU/MU-MIMO scheduling

R1-1610520 Way Forward on the QCL for NR Intel, LGE, Ericsson, NTT DOCOMO, Samsung

- QCL framework in NR is extended with new spatial QCL parameter(s) to support UE side beamforming
  - FFS channel parameters for QCL
    - Option A: Receive angle of arrival (exact wording is FFS)
    - Option B: Spatial correlation
- NR supports at least two QCL assumptions for DM-RS antenna ports
  - All ports are QCL-ed
  - Not all ports are QCL-ed
  - FFS on details
- FFS
  - QCL between antenna ports transmitted on different CCs
  - QCL between CSI-RS antenna ports within one CSI-RS resource
    - All ports are QCL-ed
    - Not all ports are QCL-ed
  - QCL of a DM-RS antenna port with other RS types

Decision: The document is noted. Continue offline discussion until Wednesday

Agreements:

- QCL framework in NR is extended with new spatial QCL parameter(s) to support UE side beamforming/receiving procedure
  - FFS details (e.g., receive angle of arrival, transmit angle of departure, spatial correlation of receiver antennas, Rx/Tx beamforming, etc.)
- For DM-RS antenna ports, NR supports:
  - All ports are QCL-ed
  - Not all ports are QCL-ed
    - FFS on details
- FFS, e.g.:
  - QCL between antenna ports transmitted on different CCs
  - QCL between CSI-RS antenna ports within one CSI-RS resource
    - All ports are QCL-ed
    - Not all ports are QCL-ed
  - QCL between CSI-RS antenna ports within two or more CSI-RS resources
    - All ports are QCL-ed
    - Not all ports are QCL-ed
  - QCL of a DM-RS antenna port with other RS types
  - QCL considering channel reciprocity

R1-1610513 Way Forward on QCL for NR ZTE Corporation, ZTE Microelectronics

- Additional parameters should be included into the definition of QCL in NR:
  - Angle of arrival/departure, angular spread
- Flexible configuration/indication of the QCL assumption should be studied in NR:
  - Possible grouping of the QCL parameters should be studied:
    - e.g., average gain, average delay
    - e.g., angle of arrival/ departure, delay spread, Doppler spread
  - The configurations of QCL assumption could be conducted in two ways:
    - TRP centric
      - e.g., according to transmission mode
      - e.g., according to antenna structure
      - e.g., according to channel reciprocity
      - e.g., according to UE feedback
    - UE centric
      - e.g., according to UE measurement
      - e.g., according to channel reciprocity

Decision: The document is noted. Also supported by Qualcomm

Agreements:

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- Flexible configuration/indication of the QCL assumption should be studied in NR:
  - Possible grouping of the QCL parameters should be studied:
    - e.g., average gain, average delay
    - e.g., angle of arrival/ departure, delay spread, Doppler spread

R1-1610747 Way Forward on RS for Phase Tracking for CP-OFDM Huawei, HiSilicon, LG Electronics, Samsung, NTT DOCOMO, INC., Intel

- For CP-OFDM waveform, for the RS enabling phase tracking, the following should be studied:
  - Time domain pattern
    - Alt-1: Continuous mapping, i.e., on every OFDM symbol
    - Alt-2: Non-continuous mapping, e.g., every other OFDM symbol
    - Switching between Alt-1 and Alt-2 can also be considered
  - Frequency domain pattern
    - Alt-A: Shared and across full carrier bandwidth with fixed density/spacing
    - Alt-B: Within each UE's scheduled bandwidth and with configurable density/spacing
    - Other patterns are not precluded
  - Other properties
    - UE-specific and/or non-UE-specific
    - Port multiplexing such as FDM/TDM/CDM
    - Potential sharing across users/streams
    - On-off configuration

Decision: The document is agreed.

R1-1610719 Way Forward on evaluation assumptions for Compensation of Phase Rotation and Frequency Offset LG Electronics, InterDigital, KT, Huawei

Decision: The document is noted. Continue offline discussion until Wednesday

R1-1610829 WF on evaluation assumptions for tracking of phase rotation and/or frequency offset LG Electronics, Nokia, Huawei, Samsung, Qualcomm, InterDigital, KT
R1-1611012 WF on evaluation assumptions for tracking of phase rotation and/or frequency offset LG Electronics, Nokia, Huawei, Samsung, Qualcomm, InterDigital, KT, ZTE

R1-1611046 WF on SRS transmission CATT, Nokia, ASB

Agreements:

- NR supports configurable SRS bandwidth
  - Partial-band size can be configured
    - Partial-band is smaller than the largest transmission bandwidth supported by the UE
    - Within a partial-band the PRBs for SRS transmission can at least be consecutive in the freq. domain
      - FFS: Size of partial band
      - FFS: Non-consecutive within partial band
    - FFS: Multiple partial-bands transmitted simultaneously considering impact with OFDM and DFT-S-OFDM waveforms
      - FFS: Simultaneous transmission can be from multiple panels.
    - FFS: Frequency hopping of partial bands
  - Full band size can be configured
    - Equal to the largest transmission bandwidth supported by the UE
- NR supports aperiodic SRS transmission triggered by the network
  - FFS on other trigger mechanism, e.g. event triggered
  - FFS on multi-shot SRS transmission, e.g. the UE transmits SRS multiple times with single trigger from network
- FFS: NR supports at least one of followings
  - Periodic SRS transmission
  - Semi-persistent SRS transmission
- FFS: NR supports multiple numerologies for SRS transmission from one UE

Not treated.
R1-1608673 Discussion on demodulation reference signal for NR MIMO ZTE, ZTE Microelectronics
R1-1608674 Discussion on measurement related reference signal for NR-MIMO ZTE, ZTE Microelectronics
R1-1608778 DMRS design for NR CATT
R1-1608779 Consideration on SRS transmission for NR CATT

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R1-1608780 Consideration on CSI-RS transmission for NR CATT
R1-1608781 Discussion on phase noise compensation RS for NR CATT
R1-1608816 Principles for DL Reference Signal Design and QCL Assumptions Huawei, HiSilicon
R1-1608817 DL RS design for NR CSI acquisition and beam management Huawei, HiSilicon
R1-1608818 Reference signal design for demodulation in NR Huawei, HiSilicon
R1-1608923 Discussion on UL sounding RS design Spreadtrum Communications
R1-1609094 DMRS Design Aspects for NR Samsung
R1-1609096 UL CSI-RS (SRS) design for NR Samsung
R1-1609097 Further discussions on QCL in NR Samsung
R1-1609098 Discussions on CSI-RS design for NR MIMO Samsung
R1-1609100 On the support of compensation of phase rotation in NR Samsung
R1-1609256 Discussion on beam coordination and QCL for NR LG Electronics
R1-1609257 Design considerations on NR CSI-RS LG Electronics
R1-1609258 Discussion on UL sounding signal design for NR LG Electronics
R1-1609259 Issues on NR DMRS Design LG Electronics
R1-1609260 Discussion on NR DMRS Pattern LG Electronics
R1-1609413 Reference Signal design for UL based measurement, CSI acquisition, and beam management Huawei, HiSilicon
R1-1609418 DL RS design for downlink-based RRM measurement and TRP/beam discovery Huawei, HiSilicon
R1-1609524 Study on QCL of DM-RS antenna ports Intel Corporation
R1-1609525 On QCL to support UE beam management Intel Corporation
R1-1609526 On the need of QCL for NR Intel Corporation
R1-1609528 Discussion on CSI-RS design for NR Intel Corporation
R1-1609529 Study of phase noise tracking Intel Corporation
R1-1609695 Views on NR Reference Signal for Beam and CSI measurement Beijing Xinwei Telecom Techn.
R1-1609764 On UL RS for CSI measurements Ericsson
R1-1609765 CSI-RS Design Ericsson
R1-1609766 Discussion on QCL Ericsson
R1-1609767 Demodulation reference signal design principles Ericsson
R1-1609768 Frame structure and DMRS positions Ericsson
R1-1609769 DMRS density configurations in the time domain Ericsson
R1-1609770 DMRS placement configurations Ericsson
R1-1609771 On PRB bundling for NR Ericsson
R1-1609772 Concatenated block RS design Ericsson
R1-1609773 IC friendliness vs configurable DMRS Ericsson
R1-1609909 Considerations on demodulation RS design for NR InterDigital Communications
R1-1609910 Considerations on measurement RS design for NR InterDigital Communications
R1-1609911 On the need of phase noise correction reference signal InterDigital Communications
R1-1610070 CSI-RS design for NR NTT DOCOMO, INC.
R1-1610079 Views on RS for demodulation and tracking NTT DOCOMO, INC.
R1-1610115 UL reference signal design for eMBB with CP-OFDM and DFT-s-OFDM Qualcomm Incorporated
R1-1610151 Views on RS for CSI acquisition Qualcomm Incorporated
R1-1610152 Views on DL DMRS Qualcomm Incorporated
R1-1610153 Views on RS for control and tracking Qualcomm Incorporated
R1-1610226 CSI acquisition frameworks for NR MU-MIMO Mitsubishi Electric Co.
R1-1610269 Reference symbols supporting CSI acquisition framework Nokia, Alcatel-Lucent Shanghai Bell
R1-1610270 Flexible CSI-RS configuration for CSI measurement Nokia, Alcatel-Lucent Shanghai Bell
R1-1610271 On the DMRS structure for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610272 On the number of antenna ports to be supported in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610273 UL SRS design considerations in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610274 On QCL Configurations in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610275 Extended framework for QCL assumptions Nokia, Alcatel-Lucent Shanghai Bell
R1-1610276 On PCRS Design for NR Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-1610277 On the evaluation of PN model Nokia, Alcatel-Lucent Shanghai Bell
R1-1610317 On the DM-RS structure Ericsson
R1-1610429 Discussion on DM-RS design for NR Intel Corporation

8.1.4.5 Other

Including phase 1 calibration results and MIMO calibration related assumptions

R1-1608661 Summary of [86-20] email discussion on MIMO calibration for NR ZTE, ZTE Microelectronics
Continue offline discussion about MIMO calibration until Thursday – Ruyue (ZTE)

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R1-1610888 WF on NR MIMO calibration ZTE, ZTE Microelectronics, Nokia, ASB, CATT, MediaTek, Xinwei, Huawei, Hisilicon, Intel, Ericsson, Mitsubishi Electric, Samsung

- Companies are encouraged to provide/update results for Phase 1 NR MIMO calibration in RAN1#87, including link level and system level simulations
  - Extend the email discussion for further clarification on simulation assumptions and metrics, if needed
- Start the email discussion on simulation assumptions and metrics for Phase 2 NR MIMO calibration, including link level and system level simulations

Decision: The document is agreed. Further revised as follows:

Agreements:

- Companies are encouraged to provide/update results for Phase 1 NR MIMO calibration in RAN1#87, including link level and system level simulations
  - Extend the email discussion for further clarification on simulation assumptions and metrics, if needed
- Email discussion about the calibration work until 28th October – Ruyue (ZTE)
- Including discussions on simulation assumptions and metrics for Phase 2 NR MIMO calibration, including link level and system level simulations

R1-1610889 WF on Phase 1 link-level calibration for NR-MIMO with simplified antenna configuration ZTE, ZTE Microelectronics, CATT, MediaTek, Xinwei, Huawei, Hisilicon, Intel, Ericsson, Nokia, ASB, Mitsubishi Electric, NTT DOCOMO, Samsung

R1-1610890 Further clarification on assumptions for Phase 1 NR-MIMO calibration ZTE

All proponents are recommended to have calibration work considering clarifications in R1-1610890

R1-1610999 WF on UL Power Control Huawei, HiSilicon, Intel

Agreements:

- The following aspects should be considered for UL PC design:
  - No LTE-like cell-specific reference signal for path loss estimate
  - Beam-based transmissions/receptions
  - Analog beamforming at eNB/UE
  - Multi-beam / multi-stream transmissions
  - Multiple numerologies
  - Inter-TRP information exchange
  - FFS: Dynamic TDD
  - Other aspects are not precluded
- The following design of UL PC as starting point for study:
  - Fractional power control in LTE as framework
  - DL RS for path loss measurement
    - e.g. RS in DL beam management P-1, P-2 and P-3 for multi-beam scenario or single-beam scenario
  - Separate PC settings for UL control and data channel
- FFS: the following design of UL PC
  - Numerology-specific parameter setting
  - Separate PC settings for multi-beam / multi-stream UL

Not treated.

R1-1608662 Phase 1 calibration results for NR MIMO ZTE, ZTE Microelectronics
R1-1608663 Calibration and evaluation assumptions for NR MIMO ZTE, ZTE Microelectronics
R1-1608821 UL power control for NR MIMO Huawei, HiSilicon
R1-1609099 MIMO LLS calibration results for NR on 4GHz frequency band Samsung
R1-1609166 MIMO SLS calibration results for NR on 30GHz frequency band Samsung Electronics Co., Ltd
R1-1609262 Phase 1 system level calibration results for NR MIMO LG Electronics
R1-1609445 Discussion on MIMO calibration Huawei, HiSilicon
R1-1609530 Evaluation results of NR below 6GHz Intel Corporation
R1-1609531 Discussion on UL Power Control Intel Corporation
R1-1609532 Evaluation results of NR above 6GHz Intel Corporation
R1-1609725 Over The Air Calibration For Reciprocity Based MIMO National Instruments Corp.
R1-1610071 Initial investigation of the impact of UE movement NTT DOCOMO, INC.
R1-1610072 Phase-1 MIMO calibration results NTT DOCOMO, INC.
R1-1610103 Initial NR MIMO Calibration Results Beijing Xinwei Telecom Techn.
R1-1610154 Phase 1 calibration results for sub6GHz and Phase 2 calibration assumptions Qualcomm Incorporated

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R1-1610155 Phase 1 calibration results for above 6GHz and Phase 2 calibration assumptions Qualcomm Incorporated
R1-1610231 Initial results for Phase 1 link level MIMO calibration for NR Mitsubishi Electric Co.
R1-1610232 UL power control in multi-beam based approaches ASUSTEK COMPUTER (SHANGHAI)
R1-1610278 On-demand power boost and cell muting for URLLC in the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1610279 Latency assumptions for network-based coordination studies Nokia, Alcatel-Lucent Shanghai Bell
R1-1610280 Interference Aware Inter Cell Rank Coordination Nokia, Alcatel-Lucent Shanghai Bell
R1-1610281 UL Interference Coordination and Power Control Nokia, Alcatel-Lucent Shanghai Bell
R1-1610282 Dynamic TDD DL-to-UL Interference Cancellation using Packet Exchange in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610283 Power control for MIMO Nokia, Alcatel-Lucent Shanghai Bell
R1-1610284 MIMO link level calibration results Nokia, Alcatel-Lucent Shanghai Bell
R1-1610285 MIMO system level calibration results Nokia, Alcatel-Lucent Shanghai Bell
R1-1610443 MIMO LLS calibration results for NR on 30GHz frequency band Samsung Electronics Co., Ltd
R1-1610445 MIMO calibration for NR – system level InterDigital Communications
R1-1610939 Phase 1 link level calibration results for NR MIMO LG Electronics

8.1.5 Aspects related to initial access and mobility

Discuss PHY layer aspects related to initial access and mobility, considering beamforming aspects, for standalone and non-standalone operation

R1-1608823 Unified single/multiple beam-based initial access procedure in NR Huawei, HiSilicon
R1-1609387 Initial Access and Mobility Requirements for NR AT&T GNS Belgium SPRL
R1-1610422 New Radio MIMO Access Procedures National Instruments Corp. (rev. of R1-1609722)

8.1.5.1 Synchronization signal and DL broadcast signal/channel

R1-1608924 Discussion on Synchronization signal design Spreadtrum Communications

The document was presented by Arto Lehti from Spreadtrum.

Observation 1: A truncated sequence from a pseudo-random sequence could keep the auto-/cross-correlation properties, while the one from a ZC sequence would lose the auto-/cross-correlation properties thereof.
Proposal 1: The pseudo-random sequence could be as the base sequence for NR synchronization signal or broadcasted signal.
Proposal 2: To enable narrowband UEs and wideband UEs to decode the same synchronization signal or broadcasted signal with no prior knowledge about wideband UEs at narrowband UEs, the base sequence could be shifted circularly to guarantee the narrowband UEs' synchronization signal or broadcasted signal to start from the front part of the base sequence.

Decision: The document is noted.

R1-1610435 Link level simulation results for NR initial synchronization and cell search MediaTek Inc. (R1-1609330)

The document was presented by … from MediaTek.

Proposal: The NR downlink synchronization signals should be transmitted less frequently than LTE to minimize the transmission of always-on signals for better forward compatibility. To reduce initial access latency, the signals should be designed in a way such that it can be detected and accurately synchronized to in a single observation with high probability.

Decision: The document is noted.

R1-1609436 Support of multiple numerologies in synchronization signal design Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei.

Observation 1: It is implementation efficient that NR synchronization signal is based on subcarrier spacing(s) supported for a given frequency band.
Observation 2: Single subcarrier spacing for all frequency ranges is not implementation efficient.
Proposal 1: The synchronization signal is common at the receiver side regardless of the subcarrier spacing used in a NR carrier for a given frequency range.
Proposal 2: The common synchronization signal is defined using a pre-defined subcarrier spacing for a given frequency range.
Proposal 3: The common synchronization signal has X repetitions. The repetition factor X is the ratio of two subcarrier spacing values defined for synchronization signals.

Decision: The document is noted.

R1-1610156 Single beam SYNC design Qualcomm Incorporated

The document was presented by Tingfang Ji from Qualcomm.

- *Observation 1: An efficient frequency scan procedure should be investigated for NR*

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- *Observation 2: Designing NR synchronization signals should take into account the known issues in LTE synchronization signals*
- *Proposal 1: NR synchronization raster is a multiple of least common multiples of channel raster and reference NR subcarrier spacing.*
- *Proposal 2: NR synchronization signal bandwidth should depend on the synchronization raster and the minimum channel bandwidth.*
- *Proposal 3: NR Sub6 synchronization signal bandwidth is at most 5MHz.*
- *Proposal 4: RAN1 should consider the Alt 1 for selecting synchronization numerology and use 30kHz as synchronization signal numerology for Sub6.*
- *Proposal 5: The periodicity of the synchronization signals is proposed to be 5ms.*
- *Proposal 6: The synchronization signals are mapped into the downlink regular burst of the downlink-centric subframe.*
- *Proposal 7: Consider the single synchronization channel and dual synchronization channel design options to support both uplink-based and downlink-based mobility when designing the synchronization signals*

Decision: The document is noted.

R1-1610159 Multi-beam SYNC design Qualcomm Incorporated

Proposal 1: The design should allow base stations to sweep beams during synchronization and random access period.
Proposal 2: The transmission of sync signals is limited to the minimum supportable bandwidth. The value of the minimum supportable bandwidth is FFS (example: 40MHz).
Proposal 3: No data/control channel is frequency-multiplexed with the sync transmission.
Proposal 4: Every X msec, Y msec worth of resources are allocated for the transmission of a synchronization burst. Each synchronization burst consists of N nominal sync signals. The exact values of X, Y and N are FFS (example: X=5, Y=0.25, N=14).
Proposal 5: The max sync (beam sweep) periodicity Z is known by the UEs. The exact value of Z is FFS (example: sync periodicity = sync resource periodicity: Z=X=5 [msec]).
Proposal 6: BS needs to convey alongside the sync signals the OFDM symbol index (or another suitable notion of transmission time) of the transmission.
Proposal 7: The directional PSS, SSS and PBCH signals are TDMed within a nominal sync symbol, and are transmitted using the same beam.
Proposal 8: The design of the primary sync signal is based on a Zadoff-Chu sequence with a prime length L, and three different root indices. L is proposed to be 127, and exact choice of the root indices is FFS.
Proposal 9: The design of the secondary sync signal is based on a base m-sequence, repeated and interleaved in frequency domain. The transmission of SSS signal from different antenna ports may be pre-coded to provide channel estimation for 2-layer PBCH decoding.
Proposal 10: The design should support PBCH transmit diversity with upto P ports. P=2 is supported. Whether P>2 is FFS.
Proposal 11: The design should permit combining of PBCH from multiple transmissions within a burst.

Decision: The document is noted.

R1-1610498 Way Forward on NR initial access signals/channels NTT DOCOMO, Intel Corporation, Ericsson, Qualcomm, InterDigital

The document was presented by Hiroki Harada from NTT DOCOMO.
Decision: The document is noted and modified as follows:

Agreements:

- NR defines at least two types of synchronization signals
  - NR-PSS at least for initial symbol boundary synchronization to the NR cell
    - FFS other functionality provided by NR-PSS, e.g., part of NR cell ID, serving as DMRS for NR-SSS, detection of subcarrier spacing
  - NR-SSS for detection of NR cell ID or at least part of NR cell ID
    - Number of NR cell IDs is targeted to be at least 504
      - FFS: larger than that in LTE
      - FFS number of NR cell IDs
    - NR-SSS detection is based on the fixed time/freq. relationship with NR-PSS resource position irrespective of duplex mode and beam operation type at least within a given frequency range and CP overhead
      - FFS FDM or TDM
    - FFS other functionality provided by NR-SSS, e.g., demodulation of broadcast channel, RRM measurement, deriving subframe index, deriving symbol index
- NR defines at least one broadcast channel: NR-PBCH
  - NR-PBCH decoding is based on the fixed relationship with NR-PSS and/or NR-SSS resource position irrespective of duplex mode and beam operation type at least within a given frequency range and CP overhead

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        - FFS: Unlicensed spectrum case
    - FFS relationship between NR-PBCH subcarrier spacing and NR-PSS and/or SSS subcarrier spacing
    - Following broadcasting schemes to carry essential system information can be considered
        - Option 1: NR-PBCH carries a part of essential system information for initial access including information necessary for UE to receive channel carrying remaining essential system information
        - Option 2: NR-PBCH carries minimum information necessary for UE to perform initial UL transmission (not limited to NR-PRACH) in addition to information in Option 1
        - Option 3: NR-PBCH carries all essential system information for initial access
        - Other options are not precluded

Possible agreements:
- Wider transmission bandwidth for NR-PSS/SSS/PBCH than that for LTE-PSS/SSS/PBCH is supported at least for a subcarrier spacing larger than 15kHz
    - Below 6 GHz, transmission bandwidth containing NR-PSS/SSS/PBCH is not more than [5] MHz
    - Below 40 GHz, transmission bandwidth containing NR-PSS/SSS/PBCH is not more than [40] MHz

Continue offline discussion until Tuesday – Hiroki (NTT DOCOMO)

Tuesday

Working assumption:
- Wider transmission bandwidth for NR-PSS/SSS and/or PBCH than that for LTE-PSS/SSS/PBCH is supported at least for a subcarrier spacing larger than 15kHz
    - Below 6 GHz, transmission bandwidth containing NR-PSS/SSS/PBCH is not more than [5 or 20] MHz
    - Below 40 GHz, transmission bandwidth containing NR-PSS/SSS/PBCH is not more than [40 or 80] MHz

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Tuesday session

R1-1610522 Way Forward on unified structure of DL sync signal Intel Corporation, NTT DOCOMO, ZTE, ZTE Microelectronics, ETRI, InterDigital
- PSS, SSS and/or PBCH can be transmitted within a 'SS block'
    - FFS: details how to compose PSS, SSS and/or PBCH
- One or multiple 'SS block(s)' compose an 'SS burst'
    - FFS: Number of 'SS block(s)' (defined as duration of 'SS burst')
    - FFS: whether or not 'SS block(s)' are consecutive
- One or multiple 'SS burst(s)' compose an 'SS burst series'
    - FFS: Periodicity and number of 'SS burst'
    - FFS: Transmission instances of 'SS burst series'

Decision: The document is noted and modified as follows:

(Agreements):
- PSS, SSS and/or PBCH can be transmitted within a 'SS block'
    - FFS: details how to compose PSS, SSS and/or PBCH
    - Multiplexing other signals are not precluded within a 'SS block'
- One or multiple 'SS block(s)' compose an 'SS burst'
    - FFS: Number of 'SS block(s)' (defined as duration of 'SS burst')
    - FFS: whether or not 'SS block(s)' are consecutive
    - FFS: whether or not 'SS block(s)' within a 'SS burst' are the same
- FFS: One or multiple 'SS burst(s)' compose a 'SS burst series'
    - FFS: Periodicity and number of 'SS burst'
    - FFS: Transmission instances of 'SS burst series' and number of ' SS burst series'

Continue discussion on FFS until Wednesday – Seunghee (Intel)
Wednesday: Above agreement is modified as follows:

Agreements:
- PSS, SSS and/or PBCH can be transmitted within a 'SS block'
    - FFS: details how to compose PSS, SSS and/or PBCH
    - Multiplexing other signals are not precluded within a 'SS block'
- One or multiple 'SS block(s)' compose an 'SS burst'
    - FFS: Number of 'SS block(s)' (defined as duration of 'SS burst')
    - FFS: whether or not 'SS block(s)' are consecutive
    - FFS: whether or not 'SS block(s)' within a 'SS burst' are the same
- One or multiple 'SS burst(s)' compose a 'SS burst set'
    - FFS: Periodicity and the number of 'SS burst' within a SS burst set
    - Number of SS bursts within a SS burst set is finite.

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- FFS: Transmission instances of 'SS burst set'
  - E.g., periodic/aperiodic transmission of SS burst sets.

R1-1610538 Way forward on SYNC periodicity Qualcomm Incorporated

- Proposal:
  - Network should have the flexibility of configuring different SYNC periodicity
  - UE should assume 5ms SYNC periodicity for acquisition unless assisted by network
- Expected UE behavior
  - Assisted search: Deployment with network assistance on frequency and timing could be configured with large SYNC periodicity and maintain high detection probability with low latency
  - Blind search:
    - Frequency layers with 5ms SYNC leads to high detection probability with low latency;
    - Frequency layers with long SYNC periodicity will have reduced UE detection probability
    - Network could configure some layers/cells to have

Discussion: Ericsson would like to see more analysis done, at this point in time could not agree the 5ms Sync figure
Decision: The document is noted. Continue discussion until Thursday – Tingfang (Qualcomm)

R1-1610722 WF on SYNC Periodicity Qualcomm Incorporated

Agreements:

- From RAN1 specification perspective, NR air interface defines at least one periodicity of SS burst set
  - FFS: whether or not to define common periodicity range for SS burst set across NR carriers
  - Values of the periodicities of SS burst set is for further study
    - E.g., 5ms, 40ms, 100ms
  - The lowest value of the periodicity of SS burst set is X ms, e.g., 5ms, 40ms, 80ms
  - Note: Interval of SS burst can be the same as interval of SS burst set in some cases, e.g., single beam operation
  - Note: the main bullet can be applied to PSS, SSS and/or PBCH
- FFS: networks is allowed to transmit SS burst set at least at the defined periodicities
- FFS: UE is allowed or informed to adapt acquisition procedure based on periodicities of SS burst set
- FFS: For example, if multiple periodicities of SS burst set are defined for initial blind acquisition, UE assumes X ms of an NR carrier as periodicity of SS burst set for dwell time on a freq

R1-1610567 Way Forward on multiplexing of sync signal Samsung

- NR supports the following multiplexing methods for nrSS and nrPBCH.
  - TDM at least for below 6 GHz with single-beam and multi-beam SFN transmissions of these signals
  - FDM at least for above 6 GHz with multi-beam sweeping transmissions of these signals

Decision: The document is noted.

R1-1610550 Way Forward on multiplexing of Sync and Broadcast signals Qualcomm Incorporated, CATT

- NR supports the time division multiplexing of PSSS, SSS and PBCH signals in both sub-6 GHz and over-6 GHz band

Decision: The document is noted. Continue study until the next meeting.

R1-1610558 WF on Synchronization Signal for NR Initial Access Huawei, HiSilicon

- SS for initial access is a predefined subcarrier spacing according to the spectrum range
- SS for initial access can be transmitted in predefined frequency locations other than the centre of a carrier
- For SS with multiple beams, at least TDM of the SS over different beams is supported;
  - FDM and CDM in addition to TDM of the SS are not precluded

Decision: The document is noted.

Agreements:

- At least one subcarrier spacing for each synchronization signal (e.g. NR PSS,SSS, PBCH) is predefined in the specification for a given frequency range
  - FFS: Subcarrier spacings for NR PSS, SSS and PBCH can be same or different.
  - Note that there are more than one frequency ranges
  - FFS: for the case when the frequency ranges are overlapped.
  - FFS: whether or not to define a single numerology or multiple numerology for frequency range
  - RAN1 should study the number of subcarrier spacings in a given frequency range and strive for minimizing the number of subcarrier spacings

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R1-1610844 Offline discussion summary of initial access for NR NTT DOCOMO
R1-1610839 WF on Updated Link Level Evaluation Assumptions for Initial Access in NR Qualcomm
Continue offline discussion until Thursday

R1-1611015 WF on Assumptions for Comparing Different SYNC Multiplexing Techniques Qualcomm

Agreements:
- Companies are encourage to provide evaluations for different multiplexing techniques for initial access
  - Use the link level parameters that got agreed in R1-1610987 and R1-1610991

R1-1610991 WF on Updated System Level Evaluation Assumptions for Initial Access in NR Qualcomm

Agreements:
- Agree on R1-1610991 with the following modification and note in R1-1611038
  - "seven sites" should be modified as "one or two cellular tiers"
  - Note: Company reports which value for the number (i.e., 1 or 2) of cellular tiers to choose for the evaluation

R1-1610959 WF on Updated Link Level Evaluation Assumptions for Initial Access in NR Qualcomm, NTT Docomo, Samsung, Intel
R1-1610987 WF on Updated Link Level Evaluation Assumptions for Initial Access in NR Qualcomm, NTT Docomo, Samsung, Intel

R1-1610954 WF on synchronization and carrier rasters Huawei, HiSilicon, Ericsson, NTT Docomo, Fujitsu
R1-1611035 WF on synchronization and carrier rasters Huawei, HiSilicon
- Email discussion on whether there is a need to support scenarios where synchronization signal(s) of neighbour cells may not be on the same center frequency
- For intra/inter frequency DL measurement, the two options below are discussed:
  - The network can signal a reduced set of frequency locations of the sync signal(s)
    - including the case where synchronizations signal(s) of neighbour cells are at the same frequency location as the synchronizations signal(s) of the UE's serving cell
  - The UE may always assume the same frequency location of the synchronization signal(s) among neighbour cells
- Email discussion on the proposal,
  - The candidate frequency locations of synchronization signal(s) are sparser than the possible frequency locations of the center of NR carrier bandwidth.
    - The spacing (Hz) between the candidate frequency locations of synchronization signal(s) may depends on the frequency bands.
    - This does not preclude that for certain bands, the candidate frequency locations of synchronization signals and the possible frequency locations of center of NR carrier bandwidth may be the same
  - A UE should not assume a fixed frequency separation between the frequency location of synchronization signal(s) and the center of NR carrier bandwidth.
- Above email discussion deadline is until 7th November – David (Huawei)
  - All proponents should focus on at least the above 3rd main bullet ant potential standard impact

R1-1611024 Offline Thursday dicussion summary of initial access for NR NTT DOCOMO, INC.

Not treated.
R1-1608711 Common signal/information allocation for initial access and mobility Mitsubishi Electric Corp
R1-1608783 NR Numerology Agnostic Synchronization Channel Design CATT
R1-1608784 NR System Bandwidth Agnostic Synchronization Channel Design CATT
R1-1608785 NR Multi-stage Synchronization Channel Design CATT
R1-1608786 QCL assumption of NR Synchronization Signals and DM RS of Broadcast Channel CATT
R1-1608812 Discussion on initial access in NR Fujitsu
R1-1608846 Synchronization signal design in NR Huawei, HiSilicon
R1-1608847 Channel raster and synchronization signal locations Huawei, HiSilicon
R1-1608906 Discussion on multi-beam based synchronization signal and DL broadcast channel for NR Guangdong OPPO Mobile Telecom.
R1-1608944 Consideration on NR synchronization signal design Sony
R1-1608951 Sub-carrier spacing considerations for NR DL Synchronization Sony
R1-1608966 Considerations on sweeping time interval in NR ZTE

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R1-1608967 Frequency and Channel Raster Issue in NR ZTE
R1-1609105 Overview on system information delivery and beam alignment/association Samsung
R1-1609106 Discussion on minimum bandwidth for NR Samsung
R1-1609107 Discussion on beam sweeping for initial access signals Samsung
R1-1609108 Time domain mapping of initial access signals for the multi-beam case Samsung
R1-1609109 Discussion on SI delivery for multi-beam before RACH Samsung
R1-1609110 Initial access design consideration for unified framework Samsung
R1-1609111 Multiplexing of synchronization signals and system information delivery channels for below 6 GHz and above 6 GHz Samsung
R1-1609112 Numerology for synchronization signal Samsung
R1-1609113 Overview on issues on NR downlink synchronization Samsung
R1-1609114 Carrier raster and synchronization signal transmission Samsung
R1-1609115 Discussion on NR paging design Samsung
R1-1609146 Discussion on numerology of synchronisation signals NEC
R1-1609147 Discussion on NR synchronization signal and essential system information mapping NEC
R1-1609152 Proposals for beamformed synchronization signals NEC
R1-1609264 Issues on NR Initial Access LG Electronics
R1-1609265 Numerology for NR Synchronization Signal LG Electronics
R1-1609308 Beam Sweeping using Multi-width Beams CMCC
R1-1609314 Initial timing and beam acquisition for multi-beam based approach KT Corp.
R1-1609328 Definition of a Downlink Basic Beacon Unit in the Unified Framework for NR Initial Access MediaTek Inc.
R1-1609329 Synchronization Signal Design in CP-OFDM Based on Time-Frequency Hopping Patterns MediaTek Inc.
R1-1609394 Design of synchronization signal for supporting different numerologies in NR ETRI
R1-1609438 Initial evaluation results for initial access Huawei, HiSilicon
R1-1609562 Consideration on narrowband anchor based access MediaTek Inc.
R1-1609668 NR Synchronization signals for idle and connected mode mobility Ericsson
R1-1609669 Overview of synchronization signal design for NR initial access Ericsson
R1-1609697 Discussion of NR Initial Access Beijing Xinwei Telecom Techn.
R1-1609701 NR synchronization signal and DL broadcast signal Panasonic Corporation
R1-1609818 NR PSS Design for Wideband and Narrowband UEs Sierra Wireless, S.A.
R1-1609875 Numerology for DL synchronization in NR Sharp
R1-1609879 Discussion on the design for synchronization signal Shenzhen Coolpad Technologies
R1-1609917 Synchronisation signal in NR Motorola Mobility
R1-1609920 Considerations for Initial Synchronization in NR InterDigital Communications
R1-1610073 Discussion on initial access design for NR NTT DOCOMO, INC.
R1-1610157 Single beam PBCH design Qualcomm Incorporated
R1-1610158 Revised simulation assumptions and metrics for SYNC evaluatoin Qualcomm Incorporated
R1-1610161 Multi-beam SYNC evaluation Qualcomm Incorporated
R1-1610203 Synchronization in NR considering beam sweeping ASUSTEK COMPUTER (SHANGHAI)
R1-1610204 Impact of multiplexing multiple numerologies on initial access ASUSTEK COMPUTER (SHANGHAI)
R1-1610207 Discussion on System Information Delivery in NR III
R1-1610242 Frame structure support for DL and UL sweeping subframes Nokia, Alcatel-Lucent Shanghai Bell
R1-1610286 Numerology for NR Synchronization Signals Nokia, Alcatel-Lucent Shanghai Bell
R1-1610287 On the synchronization signal design principle in NR Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-1610288 Beam management in initial access Nokia, Alcatel-Lucent Shanghai Bell
R1-1610289 Downlink Discovery Signal for NR Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-1610290 Initial Synch Signal Performance Results Nokia, Alcatel-Lucent Shanghai Bell
R1-1610291 Physical Layer Cell Identity in Initial Access Nokia, Alcatel-Lucent Shanghai Bell
R1-1610292 DL Signals for Mobility Measurements in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610293 Cell Identification in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1610318 Open Items in Synchronization Signal Design Nokia, Alcatel-Lucent Shanghai Bell
R1-1610351 A framework for initial access for NR INTERDIGITAL COMMUNICATIONS
R1-1610354 System information acquisition principle for NR Ericsson
R1-1610356 Considerations for DL Broadcast Channel InterDigital Communications
R1-1610371 Discussion on Sync Signal Design for NR Convida Wireless LLC
R1-1610372 Synchronization on Beamforming Initial Access Operations Convida Wireless LLC
R1-1610378 Preliminary performance evaluation of different beamforming options for NR synchronization signals Intel Corporation
R1-1610400 On NR DL synchronization Intel Corporation
R1-1610499 Performance evaluation results on NR synchronization signals NTT DOCOMO, INC.
R1-1610628 Long Network DTX in NR Ericsson
R1-1610840 Way Forward on Multiplexing of SYNC and Broadcast Signals Qualcomm

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8.1.5.2 RACH procedure

R1-1608968 Unified Random Access in NR ZTE

The document was presented by … from ZTE.

Proposal 1: NR random access makes use of Rx/Tx reciprocity, when available at TRP and/or UE, to reduce the need for beam sweeping.
Proposal 2: NR initial access should support random access also without Tx/Rx reciprocity within the same framework as with Tx/Rx reciprocity.
Proposal 3: TRP should provide information to assist UE to determine UL SB(s) for preamble transmission, e.g. in SI.
Proposal 4: NR should support multiple preamble transmission before RAR is received
Proposal 5: Open loop, closed loop and hybrid schemes for RAR transmission should be studied by RAN1.
Proposal 6: The RAR should indicate to which UL SB and UL STI it corresponds.
Proposal 7: RAN1 should study random access for connected mode UEs, based on RS for connected mode mobility.
Proposal 8: The group of preambles available to idle mode UEs should be configurable, with at least the same level of flexibility as in LTE.

Decision: The document is noted.

R1-1609672 NR PRACH preamble evaluations Ericsson

The document was presented by Asbjorn Grovlen from Ericsson.

- Observation 1: The PRACH preamble detector can be configured with varying number of non-coherent intervals (Nnc) when the preamble is constructed by repeating one short sequence
- Observation 2: The PRACH preamble detection performance can improved as compared to LTE release 8, with a PRACH preamble format which enables non-coherent accumulations in the detector.

Decision: The document is noted.

R1-1609735 Zero-Header Zero-Tail Random Access Preambles for New Radio Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by … from Nokia.

Proposal 1: ZHZT PRACH preambles should be further studied as an option for the random access of 5G New Radio.

Decision: The document is noted.

R1-1609533 Time Advance derivation for non-reciprocal UE Intel Corporation

The document was presented by Yuan Zhu from Intel.

- Observation 1: UE beamforming gain can be leveraged to improve the coverage of downlink beam management P-1 and PRACH transmission.
- Observation 2: Independent downlink/uplink beam sweep may result in large TA range.
- Observation 3: The additional TA range Δt caused by independent DL/UL beam sweep can be comparable to CP length.

Decision: The document is noted.

R1-1610056 Design for RACH preamble for NR NTT DOCOMO, INC.

The document was presented by Kazuaki Takeda from NTT DOCOMO.

- Proposal 1: The RACH preamble format(s) in LTE should be considered as the basic RACH preamble.
- Proposal 2:
- Scalable numerologies are applied to the basic RACH preamble.
  - Scaling factor of 2^n is considered.
- Observation:
- The MCL for RACH preamble is degraded when larger subcarrier spacing/BW. However, larger subcarrier spacing is robust against higher Doppler frequency.
- Scalable RACH preamble would be applicable to higher carrier frequency and multi-beam operation.

Decision: The document is noted.

Tuesday session

R1-1610489 Way Forward on RACH procedure for multi-beam operation NTT DOCOMO, ETRI, Qualcomm, Nokia, Alcatel-Lucent Shanghai-Bell, ZTE

When Tx/Rx reciprocity is available at both gNB and UE, the following RACH procedure is considered for at least UE in idle mode

- Association between one or multiple occasions for DL broadcast channel/signal and a subset of RACH occasions is partially or fully informed by broadcast system information (e.g., PBCH)
  - Signaling of "non-association" can be also included
  - Detailed design for RACH preamble should be further studied
- Based on the DL Tx beam measurement and the corresponding association, UE selects the subset of RACH occasions
- At gNB, the DL Tx beam for the UE is obtained based on the detected RACH preamble and would be also applied to Message 2

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- UL grant in message 2 may indicate the transmission timing of message 3.

For the cases with and without Tx/Rx reciprocity, the common random access procedure should be strived.
When Tx/Rx reciprocity is not available, the the following could be further considered for at least UE in idle mode

- Whether or how to report DL Tx beam to gNB, e.g.,
  - RACH preamble
  - Msg. 3
- Whether or how to indicate UL Tx beam to the UE, e.g.,
  - RAR

Decision: The document is noted, modified and agreed as follows:

Agreements:

- When Tx/Rx reciprocity is available at gNB at least for multiple beams operation, the following RACH procedure is considered for at least UE in idle mode
  - Association between one or multiple occasions for DL broadcast channel/signal and a subset of RACH occasions is informed to UE by broadcast system information or known to UE
    - FFS: Signaling of "non-association"
    - Detailed design for RACH preamble should be further studied
  - Based on the DL measurement and the corresponding association, UE selects the subset of RACH occasions
    - FFS: Tx beam selection for RACH preamble transmission
  - At gNB, the DL Tx beam for the UE can be obtained based on the detected RACH preamble and would be also applied to Message 2
    - UL grant in message 2 may indicate the transmission timing of message 3
- For the cases with and without Tx/Rx reciprocity, the common random access procedure should be strived
- When Tx/Rx reciprocity is not available, the the following could be further considered for at least UE in idle mode
  - Whether or how to report DL Tx beam to gNB, e.g.,
    - RACH preamble/resource
    - Msg. 3
  - Whether or how to indicate UL Tx beam to the UE, e.g.,
    - RAR

R1-1610854 WF on NR RACH Procedure Huawei, HiSilicon, Qualcomm, ETRI (R1-1610846)

- RAN1 is currently studying to see potential benefits of a simplified RA procedure consisting of two main steps (Msg1 and Msg2) for UEs
  - Use of a UE identity in Msg 1
  - Msg 2: RA response is addressed to the UE identity in Msg 1
  - FFS on the definition and choice of the UE identity

Decision: The document is noted. Continue offline discussion until Thursday

R1-1610978 WF on NR RACH Procedure Huawei, HiSilicon, NTT Docomo, Qualcomm, ETRI, Intel, Nokia

Agreements:

- RAN1 is studying and some companies see potential benefits of a simplified RACH procedure consisting of two main steps (Msg1 and Msg2) for UEs
- RAN1 has discussed the following:
  - The use of a UE identity in Msg 1
  - Msg 2: RA response that is addressed to the UE identity in Msg 1
  - FFS on the definition and choice of the UE identity
  - FFS on the applicability scenarios of simplified RACH procedure
- RAN1 to send LS to RAN2
- RAN1 is aware that RAN2 is also studying the RACH procedure and RAN1 would like to inform RAN2 to take the above into considerations and would like to request any feedback on UE identities and associated procedure and also ask the corresponding applicable scenarios

R1-1610990 [Draft] LS on NR RACH Procedure Huawei

Decision: The document is noted and final LS is agreed in R1-1610992

R1-1610783 WF on RACH Procedure for Multi-beam without gNB reciprocity ZTE, ZTE Microelectronics, Nokia, NTT DOCOMO

- RACH occasion:
  - A time-frequency resource and a subset of preambles.

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- Subset of RACH occasions:
  - One or more RACH occasions
- Multiple/repeated UE preamble transmission within a subset of RACH occasions is informed by broadcast system information
  - To cover gNB RX beam sweeping in case of NO Tx/Rx reciprocity at the gNB

Decision: The document is noted and modified as follows:

Agreements:

- RACH resource:
  - A time-frequency resource to send RACH preamble
- Whether UE needs to transmit one or multiple/repeated preamble within a subset of RACH resoueces can be informed by broadcast system information
  - For example, to cover gNB RX beam sweeping in case of NO Tx/Rx reciprocity at the gNB

R1-1610849 WF on definition of Beam reciprocity Samsung

- The followings are defined for Tx/Rx beam reciprocity at TRP and UE :
  - **Tx/Rx beam reciprocity at TRP:**
    - TRP is able to determine a TRP Rx beam for the uplink reception based on UE's downlink measurement report on TRP's Tx beam.
    - TRP is able to determine a TRP Tx beam for the downlink transmission based on TRPs uplink measurement on TRP's Rx beams
  - **Tx/Rx beam reciprocity at UE:**
    - UE is able to determine a UE Tx beam for the uplink transmission based on UE's downlink measurement on UE's Rx beams.
    - UE is able to determine a UE Rx beam for the downlink reception based TRP uplink measurement on UE's Tx beam.

Decision: The document is noted. Also supported by Qualcomm. Continue offline discussion until Thursday.

R1-1610962 WF on Unified RACH Procedure ZTE, ZTE Microelectronics, NTT DOCOMO, Nokia, Alcatel-Lucent Shanghai Bell, Sharp, Intel

R1-1610960 WF on RACH Preamble NTT DOCOMO, Intel, Sharp, ZTE

Agreements:

- NR supports multiple RACH preamble formats, including at least
  - RACH preamble format with longer preamble length
  - RACH preamble format with shorter preamble length
  - FFS how many signatures (e.g. number of RACH sequences, payload size, etc.)
- Multiple/repeated RACH preambles in a RACH resource is supported
  - FFS: How to support single-beam and/or multi-beam operation
  - FFS: Preamble could be the same or different
- Numerology for RACH preamble can be different depending on frequency ranges
  - FFS: How many numerologies will be supported per frequency range
- ~~FFS:~~ Numerology for RACH preamble can be different or the same from that for the other UL data/control channels

R1-1610976 WF on Updated Link Level Evaluation Assumptions for RACH Preamble Qualcomm
R1-1610986 WF on Updated Link Level Evaluation Assumptions for RACH Preamble Qualcomm

R1-1611011 WF on RACH Preamble Evaluation Assumption Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO

Agreements:

- In the evaluation for RACH preamble transmission and RACH resource selection, companies report the following assumptions
  - Support of Rx beam sweeping at the base station
  - Support of coverage, e.g., the values defined in TR38.913

Not treated.
R1-1608712 RACH preamble transmission Mitsubishi Electric Corp
R1-1608787 NR RACH Procedure CATT
R1-1608788 NR RACH Preamble Design Consideration CATT

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R1-1608813 Discussion on PRACH configuration in NR Fujitsu
R1-1608824 RACH preamble and procedures for unified single/multiple beam based access Huawei, HiSilicon
R1-1608850 Views on access procedures for NR Huawei, HiSilicon
R1-1608969 On 2-step Random Access Procedure ZTE
R1-1609116 RACH procedure considering flexible UE bandwidth Samsung
R1-1609117 Discussion on RA procedure Samsung
R1-1609118 RACH design with and without beam reciprocity Samsung
R1-1609119 RACH preamble design for NR Samsung
R1-1609266 Discussion on PRACH Preamble Design for NR LG Electronics
R1-1609267 Consideration on RACH Procedure in NR LG Electronics
R1-1609309 RACH in Gradual UE-Specific (GUS) initial access CMCC
R1-1609396 Discussion RACH procedure in beamformed scenarios Lenovo
R1-1609611 Discussion on RACH procedure for high speed train scenario with relay for NR ETRI
R1-1609670 NR random access procedure Ericsson
R1-1609671 NR PRACH preamble design Ericsson
R1-1609673 NR random-access response design Ericsson
R1-1609674 NR random-access response signal format Ericsson
R1-1609736 Cyclic delay-Doppler shifted M-Sequences for New Radio PRACH Nokia, Alcatel-Lucent Shanghai Bell
R1-1609737 Random Access Principles for New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1609738 RACH resource configuration for single-beam and multi-beam operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1609876 Numerology for PRACH preamble in NR Sharp
R1-1609918 Random access in NR Motorola Mobility
R1-1610057 Design for RACH procedure for NR NTT DOCOMO, INC.
R1-1610163 Single beam RACH design Qualcomm Incorporated
R1-1610165 Multi-beam RACH procedure aspects Qualcomm Incorporated
R1-1610320 Random access aspects for beam-based NR initial access INTERDIGITAL COMMUNICATIONS
R1-1610352 Random access and support for multiple numerologies for NR INTERDIGITAL COMMUNICATIONS
R1-1610442 Multi-beam RACH design and evaluation Qualcomm Incorporated
R1-1610559 Way Forward on NR RACH design Huawei, HiSilicon

8.1.5.3 Mobility

R1-1610828 Way Forward on DL measurement for L3 mobility LG Electronics, Samsung, NTT DOCOMO

- NR supports cell-level mobility based on DL cell-level measurement (e.g. RSRP for each cell) in IDLE mode UE.
  - Study the following DL signals for IDLE mode RRM measurement
    - Option 1: Synchronization signal (i.e. NR-SSS)
    - Option 2: DM-RS for broadcast channel.
    - Option 3: (Beam) Measurement RS which is carrying cell-ID.
    - Other options are not precluded
- For L3 mobility based on DL measurement in CONNECTED mode UE:
  - Non-UE-specific DL signals are used for CONNECTED mode RRM measurement
  - Study the following DL signals for CONNECTED mode RRM measurement
    - Option 1: Cell related RS which is carrying Cell-ID (e.g. NR-SSS)
    - Option 2: (Beam) Measurement RS which is carrying beam-ID and/or Cell-ID
    - Option 3: both option 1 and 2
    - Other options are not precluded
  - At least one of cell-level and beam-level measurement quantities (e.g. RSRP/RSRQ for each cell and/or each beams) is supported for RRM reporting.
  - Study the following options for RSRP/RSRQ to be reported for L3 mobility
    - Option 1: RSRP/RSRQ is derived per cell with averaging multiple beam measurements
    - Option 2: RSRP/RSRQ is derived per beam
    - Option 3: both option 1 and 2
    - Other options are not precluded

Decision: The document is noted. Continue offline discussion until Thursday

R1-1610975 WF on DL measurement for L3 mobility Samsung, LG Electronics, NTT DOCOMO, AT&T, Ericsson, Intel

Agreements:

- Note: In this WF, IDLE mode refers to a UE state similar to LTE IDLE state, whose exact definition is up to RAN2
- Note: In this WF, CONNECTED mode refers to a UE state similar to LTE CONNECTED state, whose exact definition is up to RAN2
- Note: In this WF, cell refers to NR cell which is tied to a same ID carried by NR-SS.

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  - Detailed definition of NR cell FFS
- NR supports cell-level mobility based on DL cell-level measurement (e.g. RSRP for each cell) in IDLE mode UE
  - Study the following DL signals for IDLE mode RRM measurement
    - Option 1: Synchronization signal (e.g., NR-PSS, NR-SSS)
    - Option 2: RS for demodulating broadcast channel
    - Option 3: RS for mobility
      - FFS if and how to associate the cell ID with this RS
      - FFS this RS is for multi-beam and/or single-beam
    - Option 4: Any combinations of above
    - Other options are not precluded
  - FFS: QCL definition for DL signal for IDLE mode RRM measurement
- FFS whether NR cell is defined only for "IDLE mode" or for both IDLE and CONNECTED mode

Agreements:
- For L3 mobility based on DL measurement in CONNECTED mode UE:
  - At least non-UE-specific DL signals can be used for CONNECTED mode RRM measurement
    - FFS UE-specific DL signals for this purpose
  - Study the following DL signals for CONNECTED mode RRM measurement
    - Option 1: Cell related RS which is carrying Cell-ID (e.g. NR-PSS, NR-SSS)
    - Option 2: RS for mobility
      - FFS how to associate it with beam-ID and/or Cell-ID
    - Option 3: RS for demodulating broadcast channel
    - Option 4: A combination of option 1 and 2
    - Other options are not precluded
  - At least one of cell-level and beam-level measurement quantities is supported for RRM reporting.
    - FFS which RRM measurement quantities to define, e.g., RSRP, RSRQ
  - Study the following options for RRM measurement quantities to be reported for L3 mobility:
    - Option 1: derived per cell (e.g., if multi-beam, as a function of multi-beam measurements)
    - Option 2: derived per beam
    - Option 3: A combination of option 1 and 2
    - Other options are not precluded
- FFS for other UE states (if introduced by RAN2)

R1-1610845 Way Forward on NR UL-based RRM measurement Huawei, HiSilicon, Qualcomm
- NR shall target to support UL-based RRM measurement and mobility at least in the following cases:
  - New RAN Controlled State with low activity
  - Active state L3 based NR handover
  - Active state L1/2 based NR mobility

Decision: The document is noted. Continue offline discussion until Thursday.
Thursday: Continue until next meeting

R1-1609437 Scenarios and initial evaluation for UL-based RRM measurement and mobility Huawei, HiSilicon

Observation 1: UL based measurements enable the TRP(s) selection within the NR cell.
Observation 2: Configuring UL based measurement in dense network deployment result in efficient reduction on signalling overhead and UE power consumption.
Observation 3: UL based measurement can alleviate the mobility interruption time and reduce the paging signalling overhead and HO failure rate, especially for high speed mobility and beam based operation scenarios.
Observation 4: In RAN controlled state of low-frequency dense urban scenario, UL based RRM has better or close paging performance than DL based RRM with dynamic tracking area.
Observation 5: DL based measurement should be support for L1/L2 beam management, and NR cell reselection for idle UE.
Proposal 1: NR shall support UL based RRM measurement and mobility at least in dense urban, high speed mobility and beam based scenarios.

Decision: The document is noted.

R1-1609167 Evaluation scenarios and assumptions for DL mobility at above 6GHz Samsung Electronics Co., Ltd

Observation 1: UL based mobility is not feasible at higher carrier frequencies where UE/TRX uses directional transmission/reception instead of omni-directional.

Proposal 1: Only DL based mobility is assumed for the evaluation of mobility at higher carrier frequencies (e.g. 30GHz).

Proposal 2: Evaluation for mobility like SLS should be performed in RAN2 for at least higher carrier frequencies.

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Proposal 3: For LLS evaluation assumptions, adopt the Table 1. And the performance metrics for link-level simulations are given by

- *Signal detection error performance (misdetection, false alarm)*
- *Measurement accuracy (signal level)*
- *Other metrics (e.g., PAPR) are not precluded*

Decision: The document is noted.

R1-1610167 Comparative Power Analysis between UL and DL-based Mobility Qualcomm Incorporated

Observation: In mobility challenging scenario, to achieve the same paging reliability, UL based mobility can reduce the UE power consumption compared to DL based mobility
Proposal: NR should study supporting both DL and UL based mobility

Decision: The document is noted. Further revised in R1-1610414.

R1-1610590 WF on Evaluation scenarios and assumptions for DL mobility at above-6GHz Samsung, Intel, Qualcomm

Agreements:

- Companies are encouraged to provide link simulation results for DL based mobility at above-6GHz
  - Evaluation assumptions are used in Table A.1.5-1 (TR38.802 V0.2.1)
  - LLS performance metrics to be considered
    - Measurement accuracy (signal level)
      - Difference between actual received power and estimated received power
    - Temporal tracking of beam strength

Not treated.

R1-1608789	NR RRM measurements and mobility management	CATT
R1-1608848	UL based RRM measurement and mobility	Huawei, HiSilicon
R1-1608849	DL based measurement and mobility	Huawei, HiSilicon
R1-1608970	Idle and connected mode mobility in NR	ZTE
R1-1609120	NR mobility in idle mode	Samsung
R1-1609121	NR mobility in connected-active mode	Samsung
R1-1609123	Discussion on hierarchical beam sweeping	Samsung
R1-1609124	Discussion on RS resource mapping for beam measurement	Samsung
R1-1609268	Measurement for Mobility and Beam Procedure in NR	LG Electronics
R1-1609310	On multi-beam-based mobility management	CMCC
R1-1609563	DL Based RRM Measurement for NR	MediaTek Inc.
R1-1609675	NR DL mobility measurement signal design	Ericsson
R1-1609702	Discussion on the NR mobility	Panasonic Corporation
R1-1610075	Discussion on mobility measurement design for NR	NTT DOCOMO, INC.
R1-1610168	DL based mobility DL channels	Qualcomm Incorporated
R1-1610169	DL based mobility UL channels	Qualcomm Incorporated
R1-1610170	UL based mobility DL channels	Qualcomm Incorporated
R1-1610171	UL based mobility UL channels	Qualcomm Incorporated
R1-1610172	DL mobility in above 6 GHz bands	Qualcomm Incorporated
R1-1610173	NR DL/UL mobility for active and inactive states	Qualcomm Incorporated
R1-1610296	On RRM for NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1610402	On NR initial access and mobility	Intel Corporation
R1-1610414	Comparative Power Analysis between UL and DL-based Mobility	Qualcomm Incorporated
R1-1610416	High speed mobility in NR	Nokia, Alcatel-Lucent Shanghai Bell

8.1.5.4 Other

R1-1608832	On Support of Aggregation of Carrier on Different Levels	Huawei, HiSilicon
R1-1609448	Low frequency assisted high frequency operation on initial access	Huawei, HiSilicon

8.1.6 Duplexing

R1-1610879 Chairman's notes of AI 8.1.6 on duplexing for NR Ad-Hoc chair (Qualcomm)

The document was presented by Wanshi Chen from Qualcomm.

Decision: The document is endorsed and content incorporated below.

R1-1609421	General discussion on flexible duplex	Huawei, HiSilicon

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8.1.6.1 Resource assignment and interference handling

R1-1608790 Interference management for dynamic TDD and flexible duplex CATT
R1-1608925 Discussion on duplexing modes in NR Fujitsu
R1-1609126 Dynamic TDD for latency reduction Samsung
R1-1610415 Discussion on flexible duplex operations in NR design LG Electronics (Revision of R1-1609269)
R1-1609716 On Resource Assignment and Interference Handling for Flexible TDD ZTE, ZTE Microelectronics
R1-1610176 Signaling requirements for dynamic TDD Qualcomm Incorporated
R1-1610219 On Flexible Duplexing and Associated Interference Management Techniques Ericsson
R1-1610306 Forward compatible reference signal design requirement for interference mitigation CEWiT

Conclusion:

- Continue study considering some or all of the following aspects:
  - Deployment scenarios/bands, same-/cross-operator considerations
  - Resource assignments and rate adaptations
  - Frame structure and HARQ/scheduling timing
  - Measurements for cross-link interference management
  - Signalling (e.g., OTA, backhaul, UE capability, etc.)
  - Cross-link interference management (IC/IS, power control, etc.)
  - Centralized vs. distributed interference/resource management
  - Beamforming/MIMO
  - Duplex modes (e.g., FDD/TDD, FDM/TDM, etc.)
  - Latency reduction
  - Whether or not LTE interference/resource management can be used as a starting point (as applicable)
  - Sensing
  - RS design
  - Advanced receiver
  - Timing alignment between DL and UL

R1-1610669 Way Forward on flexible duplex Huawei, HiSilicon

Agreement: Strive for a common framework for cross-link interference mitigation schemes for both paired and unpaired spectra

R1-1610627 WF on technique(s) to handle cross-link interference in flexible duplex LG Electronics, Panasonic, Huawei, HiSilicon

Not treated.

R1-1608830 Discussion on TRP-to-TRP interference mitigation schemes Huawei, HiSilicon
R1-1608831 Discussion on UE-to-UE interference mitigation schemes Huawei, HiSilicon
R1-1608838 Discussion on TDD operation on an unpaired spectrum Huawei, HiSilicon
R1-1609056 Multiplexing UL URLLC and eMBB Samsung
R1-1609125 Inter-cell Interference Management for Uncoordinated TDD Samsung
R1-1609127 Signaling of Slot Structure Samsung
R1-1609270 Semi-static DL/UL configuration for inter-cell interference coordination/handling LG Electronics
R1-1609271 Interference coordination for flexible duplex operation LG Electronics
R1-1609628 On dynamic TDD Ericsson
R1-1609704 Discussion on NR duplexing Panasonic Corporation
R1-1610085 Mechanisms for dynamic TDD NTT DOCOMO, INC.
R1-1610174 Dynamic TDD control interference considerations Qualcomm Incorporated
R1-1610175 Dynamic TDD data interference considerations Qualcomm Incorporated
R1-1610192 Resource assignment and interference handling in TDD NR RAN Intel Corporation
R1-1610768 Way Forward on dynamic TDD opreration for NR ZTE

8.1.6.2 Performance evaluation study

R1-1610634 Evaluation of flexible duplex in dense urban scenario Huawei, HiSilicon (Rev. of R1-1609423)
R1-1610087 Initial evaluation results of dynamic TDD NTT DOCOMO, INC.

R1-1610717 WF on additional offset in path-loss model for flexible duplex LG Electronics, Huawei, HiSilicon

R1-1609272 Remaining issues on evaluation assumptions for flexible duplex LG Electronics
R1-1609422 Evaluation of flexible duplex in indoor hotspot scenario Huawei, HiSilicon
R1-1609424 Evaluation of flexible duplex in urban macro scenario Huawei, HiSilicon

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R1-1610480 Dynamic TDD in dense urban scenario NTT DOCOMO, INC. (R1-1610086)

8.1.7 Scheduling/HARQ aspects

R1-1611039 Offline outcome of Thursday afternoon on 8.1.7 NTT DOCOMO

Agreements:

- For UL control channel in short duration,
  - 1 symbol duration of a slot is supported.
  - FFS: a few symbol duration of a slot is supported.
- Mechanism enabling frequency-diversity is supported.

Agreement: In frequency-domain, a PRB (or multiple PRBs) is the minimum resource unit size for UL control channel.

Agreement: UE-specific RS is used for PUCCH transmission

R1-1610946 **WF on URLLC HARQ Intel**

Agreements:

- Study how to meet RAN requirements on latency and reliability using at least one HARQ retransmission for DL data and UL data
  - Further study TTI duration and achievable latency based on at least one retransmission
  - Further study details of HARQ operation in DL and UL taking into account reliability of overall HARQ signaling procedure (control, data and feedback channels)
- This does not preclude studying single transmission to meet the RAN requirements on latency and reliability

Email discussion about DL L1/L2 control channel design until 7th November (including R1-1610671) – Stefan (Ericsson)
Email discussion about UL L1/L2 control channel design until 7th November – Stefan (Ericsson)

8.1.7.1 L1/L2 control channel design

Including DL/UL control channel structures and DCI/UCI contents

R1-1609741 **Input to control channel design from a scheduler perspective** **Nokia, Alcatel-Lucent Shanghai Bell**

The document was presented by Sigen Ye from Nokia.

- Proposal #1: Adopt a user-centric design principle, where the downlink control channel and data channel are time multiplexed on a per user basis while still limited to distinct physical resource sets. For downlink data transmissions, the downlink control channel transmission only appears in the start of the TTI.
- Proposal #2: It should be possible to configure UEs with a time-frequency domain control channel monitoring pattern, such that UEs arenot mandated to always monitor for control chanel grants over the full bandwidth at all possible time occasions, say at the start of every slot, mini-slot, or subframe.

Decision: The document is noted.

R1-1609539 **On the NR physical control channel** **Intel Corporation**

The document was presented by … from Intel.

- Proposal 1: NR PDCCH should support the scheduling of common and dedicated data transmissions.
- Proposal 2: NR PDCCH should support in-carrier scheduling of common data transmission in low frequency band as well as dedicated data transmissions in both low and high frequency band.
- Proposal 3: NR PDCCH should support variable TTIs, and blind decoding computation burden thereof shall be kept in a reasonable level.
- Proposal 4: NR should support localized control and data transmission, a.k.a. in-resource control scheduling, whereby control signaling and scheduled data are transmitted in a confined time-frequency resource grid, and can be multiplexed in hybrid time-frequency domain.
- Proposal 5: NR PDCCH should support distributed transmission in frequency domain to benefit from frequency diversity, especially when localized beamforming transmission is not possible or feasible.
- Proposal 6: The coverage of NR PDCCH at low and high frequency should be further studied by taking into account relevant deployment scenarios and appropriate beamforming gain assumption.
- Proposal 7: Both DMRS and shared reference signal should be studied for NR PDCCH demodulation.

Decision: The document is noted.

R1-1609128 **DL Control Channel Design** **Samsung**

The document was presented by Aris Papasakellariou from Samsung.

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Proposal 1: A resource block is the frequency resource unit for both PDCCH and PDSCH transmissions.
Proposal 2: A CCE includes a predetermined number of RBs. The RB interleaving is based on the REG interleaving in LTE.
Proposal 3: The duration of PDCCH transmissions is determined per transmission slot.
Proposal 4: A PDCCH transmission can span multiple symbols.
Proposal 5: A UE is signaled RBs of a system bandwidth and the transmission slots for monitoring PDCCH transmissions.

Decision: The document is noted.

R1-1610177 DL control channels overview Qualcomm Incorporated

The document was presented by Jing Jiang from Qualcomm.

Proposal 1: Agree on the need of PSFICH for NR.
Proposal 2: RS for PDCCH is transmitted on the 1st symbol in DL control region in each slot.
Proposal 3: Consider the multi-part PDCCH structure.
Proposal 4: Consider 2 symbol DL control region or 1 symbol DL control region with additional control channel in the data region.
Proposal 5: Do not consider dynamically configurable number of control symbols.
Proposal 6: Consider 2 port SFBC and CDD as a candidate diversity scheme for PDCCH.
Proposal 7: NR shall allow a smaller BW UE to operate in the system. Minimum UE BW can be [5] MHz.
Proposal 8: Introduce the subband concept for PDCCH search space with the above attributes per subband:

- UE specific search space / Common search space
  - CCE can be localized/distributed within a subband.
- Omni / Beamformed
  - For omni subband, UE can have a wideband RS processing over the subband.
  - For beamformed subband, UE should have per REG/CCE level RS processing.
- Single / Multi-part control

Proposal 9: Consider fewer hypotheses for PDCCH blind decoding based on the presented ways.

- Limit the DCI length options via quantized DCI length
- Use nested search space for each subband (example shown in Figure 1)
- Reduce the number of options for each aggregation level compared to LTE

Proposal 10: Consider flexible DCI multiplexing PDCCH for multiple UEs.
Proposal 11: Introduce pre-indication / cross slot scheduling (UL/DL) PDCCH.
Proposal 12: Introduce dynamic BW switching.

Decision: The document is noted.

R1-1609273 Overall structure of DL control transmission for NR LG Electronics

The document was presented by … from LGE.

Proposal #1: In NR system, the following two types of DL control region are to be considered.

- DL control region A
  - Non-configurable in terms of time/frequency resource and numerology
- DL control region B
  - Configurable in terms of time/frequency resource and numerology

Proposal #2: In NR system, the following two types of search space are to be considered.

- Search space A
  - DCI monitoring for broadcast data and unicast data associated with fall back operation
  - Non-configurable in terms of CCE mapping, TX scheme, and DM-RS scrambling
- Search space B
  - DCI monitoring for normal unicast data
  - Configurable in terms of CCE mapping, TX scheme, and DM-RS scrambling

Proposal #3: In DL control design for NR system, the following options need to be studied.

- Option 1
  - Search space A is located in DL control region A
  - Search space B is located in DL control region B
- Option 2
  - Search space A is located in both DL control region A and B
  - Search space B is located in DL control region B

Decision: The document is noted.

R1-1609435 Control channel design for URLLC Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei.

Observation 1: The DL assignment is needed for URLLC DL transmission considering the UE complexity, power consumption and processing delay due to data channel blind detection.
Observation 2: Both A/N-based and A/N-less operation can be considered for URLLC DL transmission.

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Observation 3: CSI reporting should be studied for URLLC DL transmission considering the sporadic traffic characteristics and latency requirement.
Observation 4: The scheduling request and UL grant are not needed for URLLC UL transmission if grant-free based scheme is adopted.
Observation 5: Both A/N-based and A/N-less operation can be considered for URLLC UL transmission.
Observation 6: The DL control channel reliability requirement depends on the number of possible transmissions within the latency bound, which is determined by the scheduling interval and interval between initial transmission and retransmission.
Observation 7: With a limited number of possible transmissions, the DL control channel reliability needs to be increased compared to LTE requirement (1%).
Observation 8: The NACK to ACK error for control channel carrying HARQ-ACK feedback should be studied for URLLC in order to guarantee the overall reliability requirement.
Proposal 1: A compact DCI format can be considered targeting URLLC where only limited scheduling information is conveyed.

Discussion: Qualcomm→ overhead issue to be considered
Decision: The document is noted.

R1-1610083 Initial views on UL control channel design NTT DOCOMO, INC.

The document was presented by Fred Takeda from NTT DOCOMO.
Proposal 1:

- *NR UL control channel(s) should support at least scheduling request, HARQ-ACK feedback, and CSI feedback.*
- *NR UL control channel(s) should be designed with the following high-level requirements:*
  - *High reliability*
    - *At least for lower carrier frequencies (e.g., below 6GHz), NR UL control channel(s) should be comparable with PUCCH for LTE, in terms of BLER/coverage performances.*
    - *For higher carrier frequencies (e.g., above 6GHz), NR UL control channel(s) have sufficient BLER/coverage performances, which could overcome the high carrier frequency specific problems.*
  - *High efficiency*
    - *NR UL control channel(s) should be efficiently multiplexed with DL data and/or UL data.*
  - *High flexibility*
    - *NR UL control channel(s) should be friendly to flexible dynamic TDD operation.*
  - *Scalability*
    - *NR UL control channel(s) should be designed for various SCSs and scheduling unit duration.*

Proposal 2: *NR UL control channel(s) should be designed such that required reliability can be properly achieved.*

- *Both BER/BLER performance evaluation and link-budget analysis would be essential.*

Decision: The document is noted.

R1-1610683 Discussion points on Downlink Control Signaling Ericsson

The document was presented by Stefan Parkvall from Ericsson. Comprehensive list (non exhaustive) of questions for RAN1 to look at.
Discussion: Chair→ intention is not trying to answer them right now but more to clarifiy the questions and revisit later in the week.
Decision: The document is noted. Continue offline discussion until Wednesday.

Wednesday

R1-1610736 Summary of offline discussion on downlink control channels Ericsson

Agreements: NR should support

- UE/PDCCH-specific DM-RS for PDCCH reception. At least for beamforming, UE may assume same precoding operation for PDCCH and associated DM-RS for PDCCH.
  - FFS: DM-RS is PDCCH-specific and/or UE-specific
- Shared/Common RS for PDCCH reception
  - Whether this sharing will be transparent to UE is FFS
  - FFS: Whether UE may assume the same precoding operation between RS and PDCCH
- FFS: QCL between antenna ports for PDCCH demodulation
- Tx diversity supported. Which scheme/how FFS

Agreements: For the frequency-domain aspects:

- A UE monitors for downlink control information in one or more "control subband"
  - This does not preclude that UE may receive additional control information elsewhere within or outside the control subband in the same or different OFDM symbol(s)
  - FFS: One DCI message is transmitted within one control subband.
- A "control subband" is smaller than or equal to the carrier bandwidth (up to a certain limit)

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- FFS if a "control subband" is non-contiguous and/or contiguous in the frequency domain.
- A "control subband" consists of an integer number of RBs/PRBs in the frequency domain
- FFS: multiplexing of multiple control channels in a subband

Agreements:
- From gNB perspective, DL control signalling can be located at the first OFDM symbol(s) in a slot and/or mini-slot
- FFS: From gNB perspective, DL control signalling can be located over the slot and/or mini-slot

Possible agreements:
- NR supports same-slot and/or same-mini-slot scheduling for both DL and UL
- NR supports cross-slot and/or cross-mini-slot scheduling for both DL and UL

Agreement:
- NR supports at least same-slot and cross-slot scheduling for DL.
    - Note: it is already agreed that NR supports same-slot and cross-slot scheduling for UL.

R1-1610566 Way Forward on NR UL control channel Samsung, Qualcomm, Intel, Panasonic, InterDigital, Sony, Ericsson, NTT DOCOMO, Fujitsu
- At least two formats are supported for NR UL control channel assuming "slot" is defined
    - Short UL control channel can be
        - transmitted in the last UL symbol(s) of a slot
        - FFS: transmitted in the first UL symbol(s) of a slot
        - TDMed and/or FDMed with UL data channel within a slot
        - TDMed with DL data/control channel within a slot
    - Long UL control channel can be
        - transmitted over multiple UL symbols to improve coverage
        - FDMed with UL data channel within a slot
        - TDMed with DL control channel within a slot
    - FFS how to multiplex with SRS
    - The frequency resource and hopping, if hopping is used, should not spread over whole bandwidth for a given UL control channel

Decision: The document is noted. Continue discussion.

Wednesday session

R1-1610808 Way Forward on NR UL control channel Samsung, Qualcomm, Intel, Panasonic, InterDigital, Sony, Ericsson, NTT DOCOMO, Fujitsu, OPPO, CATT, CMCC
- At least two ways of transmissions are supported for NR UL control channel
    - UL control channel can be transmitted in short duration
        - around the last UL symbol(s) of a slot
        - FFS: in the other positions, e.g., the first UL symbol(s) of a slot
        - TDMed and/or FDMed with UL data channel within a slot
    - UL control channel can be transmitted in long duration
        - over multiple UL symbols to improve coverage
        - FDMed with UL data channel within a slot
    - FFS how to multiplex with SRS
    - The frequency resource and hopping, if hopping is used, may not spread over the carrier bandwidth

Decision: The document is noted, modified as follows:

Agreements:
- At least two ways of transmissions are supported for NR UL control channel
    - UL control channel can be transmitted in short duration
        - around the last transmitted UL symbol(s) of a slot
            - FFS: How to define and treat the potential gap at the end of the slot
        - FFS: in the other positions, e.g., the first UL symbol(s) of a slot
        - TDMed and/or FDMed with UL data channel within a slot
    - UL control channel can be transmitted in long duration
        - over multiple UL symbols to improve coverage
        - FDMed with UL data channel within a slot
    - FFS how to multiplex with SRS
    - The frequency resource and hopping, if hopping is used, may not spread over the carrier bandwidth

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R1-1610671 Way Forward on NR DL Control ZTE, ZTE Microelectronics, Ericsson, Qualcomm, InterDigital

- For PDCCH with UE/PDCCH-specific DM-RS
  - UE/PDCCH-specific DM-RS should be mapped within the resources for each PDCCH transmission
    - A PDCCH transmission should be able to demodulated by DM-RS within its resource

Decision: The document is noted. Continue discussion.

R1-1610789 Scale numerology for DL control Qualcomm ZTE

- Study the slot structure with scaled numerology for DL control portion, relative to data portion
  - Split a control OFDM symbol to half/quarter symbols
  - FFS: Control channel performance under different numerologies, Overhead saving, Control channel capacity; Quantify timeline saving.

Decision: The document is noted.

R1-1610883 WF on Using Scaled Numerology for Control Transmission Qualcomm, ZTE, Ericsson

- Study impact and benefits of allowing the transmission of DL control information and data transmission to a UE within the same slot interval using different numerologies
- Study impact and benefits of allowing the transmission of uplink control information and data transmission from a UE within the same slot interval using different numerologies
  - The associated DMRS for data transmission still uses the same numerology as the data transmission
  - Eg. Split a control OFDM symbol to half/quarter symbols with 2/4 times SCS
  - FFS: Control channel performance under different numerologies, Overhead saving, Control channel capacity; Quantify timeline saving.

Decision: The document is noted.

Agreements:

- NR should support both data and control with the same numerology
- Study impact and benefits of allowing the transmission of DL control information and data transmission to a UE within the same slot interval using different numerologies in TDM or FDM manner
  - Above may apply both slot and mini-slot
- Study impact and benefits of allowing the transmission of uplink control information and data transmission from a UE within the same slot interval using different numerologies in TDM or FDM manner
  - Above may apply both slot and mini-slot
- Followings applies both DL and UL
  - The associated DM-RS for data/control transmission still uses the same numerology as the data/control transmission
  - FFS: Control channel performance under different numerologies, Overhead saving, Control channel capacity; Quantify timeline saving, UE complexity

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Thursday session

R1-1610943 Offline outcome of Wednesday evening on 8.1.7.1 NTT DOCOMO

Decision: The document is noted. The following offline consensus are agreed:

Agreements:

- NR should support at least the following.
  - In frequency-domain, a PRB (or a multiple of PRBs) is the resource unit size (may or may not including DM-RS) for control channel
    - This is at least for the case where the DL control region consists of one or a few OFDM symbol(s) of a slot or a mini-slot
    - FFS: whether a PRB or a multiple PRBs is the resource unit size
      - FFS: If multiple PRBs is the resource unit size, the multiple PRBs are contiguous
  - FFS: whether the resource unit size for a DL control channel is called as NR-REG or not

Agreements:

- NR should support at least the following
  - A DL control channel can be mapped on one or more NR-CCEs
    - This is at least for the case where the DL control region consists of one or a few OFDM symbol(s) of a slot or a mini-slot
    - A NR-CCE includes ~~an FFS~~ a positive integer number of PRBs (FFS: exact value)
      - FFS: whether a NR-CCE contains contiguous PRBs
      - FFS: whether multiple NR-CCEs may share one or more PRBs

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- FFS: whether NR-CCE is mapped on frequency-domain only or on both frequency and time-domain.

R1-1610784 DL control channel Huawei, HiSilicon, Qualcomm, ZTE, InterDigital, Convida Wireless

- Study one step and two (or multiple) steps control channel designs
  - One step control channel design
    - DL control channel located at the first OFDM symbol(s) in a slot
  - Two (or multiple) steps control channel design
    - A first level DL control channel located at the first OFDM symbol in a slot, which can indicate at least the time and frequency resource for the data channel
    - The second level control channel has two options
      - Opt 1: The second level control channel embedded in the associated downlink data region
        - » FFS if the demodulation RS for the second level control can be shared with the associated data channel
      - Opt 2: The second level control channel located in the later OFDM symbol(s) of the control region (not later than starting of the data region)
    - FFS: Support for first level and second level DL control channel in different slots/mini-slots

Decision: The document is noted. Continue discussion.

R1-1611036 WF on DL control channel design Huawei, HiSilicon (R1-1610784)

Email discussion until 7th November – David (Huawei)

R1-1610676 Way Forward on UCI transmission for NR LG Electronics, Intel

- For NR system, it is supported that UCI feedback is transmitted via UL data channel.
  - The UCI feedback in above at least includes the HARQ-ACK response corresponding to DL data reception
  - FFS on the details (e.g., how to enable this operation, how to map the UCI on UL data channel)

Decision: The document is noted. Continue discussion.

R1-1611005 Way forward on UCI transmission for NR LG Electronics, Intel, Panasonic

Agreements:

- Study at least the following operations to be supported in NR, from a single UE perspective
  - Case 1: UL data and UCI are FDMed where the resource for UCI is not a part of the resource allocated for UL data
  - Case 2: UL data and UCI are TDMed where the resource for UCI is not a part of the resource allocated for UL data
  - Case 3: UL data and UCI are multiplexed where the resource for UCI is a part of the resource allocated for UL data
- FFS: how different types of UCI are handled
- Further study on other possibilities is not precluded

R1-1610677 Way forward on common control channel for NR LG Electronics, Nokia

- Should be discussed as part of initial access at the next meeting.

R1-1609913 On Non-orthogonal Control Channel Design for NR InterDigital Communications

Not treated.

R1-1608676 Discussion on Control Channel Design for NR ZTE, ZTE Microelectronics
R1-1608677 Discussion on Common Control Channel for NR ZTE, ZTE Microelectronics
R1-1608791 NR DL control channel design considerations CATT
R1-1608792 NR UL control channel design considerations CATT
R1-1608793 Principle of DL DCI formats design CATT
R1-1608794 Principle of UL DCI formats design CATT
R1-1608814 DL control channel related to multiplexing eMBB and URLLC Fujitsu
R1-1608840 Discussion on uplink control channel design in NR Huawei, HiSilicon
R1-1608907 DL PHY procedure issues for multi-beam based approaches Guangdong OPPO Mobile Telecom.
R1-1609129 UL Control Channel Design Samsung
R1-1609130 Common Control Signaling Samsung
R1-1609131 DCI Formats and Contents for NR Samsung
R1-1609132 UCI Contents for NR Samsung
R1-1609158 Principles of L1/L2 Control Channel Design for NR NEC
R1-1609237 Discussion on control and data transmssion of URLLC LG Electronics

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R1-1609274	Discussion on DL control channel design for NR	LG Electronics
R1-1609275	Discussion on common control signaling for NR	LG Electronics
R1-1609276	Structure of control and data multiplexing for NR	LG Electronics
R1-1609277	Discussion on UL control channel design for NR	LG Electronics
R1-1609278	Discussion on support of CA operation in NR	LG Electronics
R1-1609311	Discussion on uplink control channel design for NR	CMCC
R1-1609432	Discussion on downlink control channel design	Huawei, HiSilicon
R1-1609534	UL control channel mapping in time	Intel Corporation
R1-1609535	UCI embedding onto UL shared channel	Intel Corporation
R1-1609536	UCI contents and UL control channel formats	Intel Corporation
R1-1609537	UL control coverage enhancement	Intel Corporation
R1-1609538	Resource allocation for NR uplink control channel	Intel Corporation
R1-1609540	Reference signal design for NR control channel	Intel Corporation
R1-1609541	On the transmission schemes of NR physical control channel	Intel Corporation
R1-1609557	On techniques for enhanced UE power efficiency	MediaTek Inc.
R1-1609558	Consideration on NR-PDCCH design	MediaTek Inc.
R1-1609559	Discussion on UL control channel design	MediaTek Inc.
R1-1609560	Preconfigured decoding or transmission candidates in NR	MediaTek Inc.
R1-1609619	On downlink control channels	Ericsson
R1-1609622	On DL HARQ feedback transmission in UL	Ericsson
R1-1609623	On fast DL HARQ feedback transmission in UL	Ericsson
R1-1609624	On scheduled DL HARQ feedback transmission in UL	Ericsson
R1-1609631	On timing of downlink control signaling	Ericsson
R1-1609705	Overview on DL control channel design	Panasonic Corporation
R1-1609739	On the DL control channel structure for NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609740	On the UL control channel structure for NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609816	Discussion on uplink control channel for NR	Panasonic Corporation
R1-1609880	Discussion on the DL control channel design	Shenzhen Coolpad Technologies
R1-1609912	Unified Control Channel Design for NR	InterDigital Communications
R1-1610058	Initial views on DL control channel design	NTT DOCOMO, INC.
R1-1610089	DL control channel framework for NR	INTERDIGITAL COMMUNICATIONS
R1-1610178	UL control channels overview	Qualcomm Incorporated
R1-1610179	UCI content	Qualcomm Incorporated
R1-1610191	Scheduling request design for NR	Intel Corporation
R1-1610379	On Downlink Control Channel Design for New Radio	Convida Wireless LLC
R1-1610779	Discussion on DL control channels	Ericsson
R1-1610811	Way Forward on NR DL Control Channel Structure	Samsung
R1-1610887	Notes from offline discussion on ulplink control channels	Ericsson

8.1.7.2 Scheduling/HARQ mechanism

Including procedures for scheduling/HARQ operation

R1-1609431 Discussion on short processing delay Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei.

Proposal 1: NR should evaluate the potential performance loss due to applying the processing time reduction methods and identify the use case of these methods.

Decision: The document is noted.

R1-1610180 Number of HARQ processes Qualcomm Incorporated

The document was presented by Jing Jiang from Qualcomm.

- Proposal 1: NR should target to single interlace self-contained HARQ process at least for some UEs and base stations in TDD mode.
- Proposal 2: NR should also target to support one (more than one FFS) multiple HARQ process mode for UE and eNBs in TDD mode.
- Proposal 3: The need of fully dynamic HARQ Ack timeline need to be investigated very carefully and justified by sufficient performance benefit.

Decision: The document is noted.

R1-1609744 HARQ operation for large transport block sizes Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by Sigen Ye from Nokia.

- Observation 1: 5G new radio is expected to support increasingly larger transport block sizes as compared to LTE. This will result in a larger number of code block segments per transport block.

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- Observation 2: Using a configurable multi-bit feedback, HARQ process can perform more efficiently by skipping the correctly decoded segments of the transport block in the retransmission.
- Observation 3: Depending on the CRC check of the code blocks the most useful information to be reported back to the transmitter may include e.g., index(es) of failed code block(s), index(es) of failed PRB('s), decoder state information, etc.
- Observation 4: The number of available bits for HARQ feedback is expected to increase by increasing carrier bandwidth. Moreover, multi-bit HARQ feedback can potentially use more bits by transport block size increasing, in order to report e.g. indexes of the failed CB's.
- Proposal 1: Requirements and benefits of configurable multi-bit HARQ feedback shall be investigated for 5G new radio.
- Proposal 2: 5G new radio shall enable partly-retransmission of transport blocks through skipping the successfully decoded segments of the transport block. Furthermore, it should allow for multiplexing of initial transmission and/or HARQ retransmission of two –or more— transport blocks.
- Proposal 3: The content of a multi-bit feedback shall be configurable in order to capture the most useful information that can fit the limited available number of feedback bits.
- Proposal 4: The size of a multi-bit HARQ feedback shall be configurable e.g., semi-statically for each UE or dynamically based on transport block size, available control signaling resources, etc.

Decision: The document is noted.

R1-1609543 On HARQ support for URLLC Intel Corporation

The document was presented by … from Intel.

- The HARQ support is considered for URLLC services.
- Further study impact from different error sources on URLLC UEs with enabled HARQ operation.

Decision: The document is noted.

Wednesday session

R1-1610631 Way forward on NR HARQ Intel, Nokia, ASB, AT&T, OPPO, MediaTek

- Timing relationship between DL data reception and corresponding acknowledgement can be dynamically indicated in the DCI
  - FFS: minimum interval
- Timing relationship between UL assignment and corresponding UL data transmission can be dynamically indicated in the DCI
  - FFS: minimum interval
- Timing relationship between DL data reception and corresponding acknowledgement can be semi-statically indicated to a UE via higher layer signaling.
  - FFS: minimum interval
- Timing relationship between UL assignment and corresponding UL data transmission can be semi-statically indicated to a UE via higher layer signaling.
  - FFS: minimum interval
- Support at least multiple DL HARQ processes to support consecutive DL transmissions for eMBB.
- Support at least multiple UL HARQ processes to support consecutive UL transmissions for eMBB.

Decision: The document is noted.

Agreements:

- NR supports operation of more than one DL HARQ processes for a given UE
- NR supports operation of more than one UL HARQ processes for a given UE
- FFS: URLLC case

Agreements:

- NR supports operation of one DL HARQ process for some UEs
- NR supports operation of one UL HARQ process for some UEs
- FFS: Conditions on supporting above 2 bullets
- Note: This does not mean the gNB has to schedule back-to-back
- Note: This does not mean the UE has to support K1=0 and/or K2 = 0

Thursday

Agreements:

- Timing relationship between DL data reception and corresponding acknowledgement can be (one or more of, FFS which ones)
  - dynamically indicated by L1 signaling (e.g., DCI)
  - semi-statically indicated to a UE via higher layer
  - a combination of indication by higher layers and dynamic L1 signaling (e.g., DCI)
- FFS: minimum interval between DL data reception and corresponding acknowledgement

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- FFS: common channels (e.g. random access)

Agreements:
- Timing relationship between UL assignment and corresponding UL data transmission can be (one or more of, FFS which ones)
  - dynamically indicated by L1 signaling (e.g., DCI)
  - semi-statically indicated to a UE via higher layer
  - a combination of indication by higher layers and dynamic L1 signaling (e.g., DCI)
- FFS: minimum interval between UL assignment and corresponding UL data transmission
- FFS: common channels (e.g. random access)

R1-1610760 Clarification on timing relationship in NR HARQ Qualcomm

R1-1610547 Way Forward on timing relationship for NR MediaTek, III, Samsung, NTT Docomo, Nokia, ASB, Qualcomm, Ericsson, Huawei, HiSilicon, Sony
- For per-slot scheduling, NR specification should support the following
  - DL data reception in slot N and corresponding acknowledgment in slot N+K1
    - All UEs should support K1≥1 with exact values for K1 FFS
    - Some UEs may support K1=0 (FFS conditions)
  - UL assignment in slot N and corresponding uplink data transmission in slot N+K2
    - All UEs should support K2≥1 with exact values for K2 FFS
    - Some UEs may support K2=0 (FFS conditions)

Decision: The document is noted and modified as follows:

Agreements:
- For slot-based scheduling, NR specification should support the following
  - DL data reception in slot N and corresponding acknowledgment in slot N+K1
    - All UEs should support K1≥1 with exact values for K1 FFS
    - Some UEs may support K1=0 (FFS conditions)
  - UL assignment in slot N and corresponding uplink data transmission in slot N+K2
    - All UEs should support K2≥1 with exact values for K2 FFS
    - Some UEs may support K2=0 (FFS conditions)

R1-1610752 Way forward on NR DCI monitoring Intel, CATT, Ericsson, Panasonic, ETRI
- DCI monitoring occasions can be configured by higher layers

Decision: The document is noted, modified and agreed as follows:

Agreement: UE-specific DL control information monitoring occasions at least in time domain can be configured

R1-1610750 WF on HARQ feedback for eMBB MediaTek

Concern under what AI this should be discussed – some would like to see it under channel coding AI

Agreements:
- At least asynchronous and adaptive HARQ is supported for eMBB.
- NR supports at least UL transmission of at least single HARQ-ACK bit.
- Consider whether/how to support more than one HARQ-ACK bits per TB.
- Consider whether/how to support single HARQ-ACK bit per multiple TBs, e.g., HARQ-ACK bundling.

Not treated.

R1-1608795	NR Scheduling procedure	CATT
R1-1608796	NR HARQ operation	CATT
R1-1608815	Scheduling and CQI feedback for URLLC	Fujitsu
R1-1608839	Discussion on timing relations for NR	Huawei, HiSilicon
R1-1608908	On DL HARQ for NR	Guangdong OPPO Mobile Telecom.
R1-1608958	On indicating HARQ timing and PUCCH	ZTE
R1-1608959	Fast scheduling and transmission for NR	ZTE
R1-1609133	Support of Flexible Scheduling Timing	Samsung
R1-1609134	Number of HARQ Processes	Samsung
R1-1609280	Discussion on HARQ timing and resource for NR	LG Electronics

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R1-1609281	Discussion on scheduling in time domain for NR	LG Electronics
R1-1609282	Discussion on HARQ latency reduction for NR	LG Electronics
R1-1609283	Discussion on potential HARQ operation in NR	LG Electronics
R1-1609284	Discussion on minimum HARQ-ACK and retransmission timing	LG Electronics
R1-1609429	Discussion on resource block for NR	Huawei, HiSilicon
R1-1609542	NR HARQ and scheduling timing	Intel Corporation
R1-1609561	Consideration on HARQ mechanism in NR	MediaTek Inc.
R1-1609706	Timing relation dependency to slots transmission direction indication method	Panasonic Corporation
R1-1609742	On HARQ/scheduling timing and self-contained operation	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609743	Enhanced redundancy matching for HARQ transmission	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609745	Early Hybrid ARQ Feedback for the 5G New Radio	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609746	HARQ Pooling for Carrier Aggregation in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609747	Punctured Scheduling for Low Latency Transmissions	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609748	Semi-persistent scheduling for 5G new radio URLLC	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609749	Pause-Resume Scheduling for Low Latency Transmissions	Nokia, Alcatel-Lucent Shanghai Bell
R1-1609801	Discussion on grant-free transmission based on sensing	ZTE
R1-1609877	DL HARQ and UL scheduling timing in NR	Sharp
R1-1610082	Multiplexing mechanism for eMBB and URLLC	NTT DOCOMO, INC.
R1-1610084	HARQ and scheduling operation for NR	NTT DOCOMO, INC.
R1-1610090	Scheduling and support of service multiplexing	INTERDIGITAL COMMUNICATIONS
R1-1610092	Reduced HARQ timing for NR	HTC Corporation
R1-1610181	DL processing time consideration	Qualcomm Incorporated
R1-1610182	UL processing time consideration	Qualcomm Incorporated
R1-1610218	Some Considerations on HARQ Feedback Mechanism	ZTE

8.1.7.3 Other

R1-1609135	Discussion on UE power consumption reduction	Samsung
R1-1609136	Signaling of Resources for forward compatibility	Samsung
R1-1609279	Discussion on UL power control procedure for NR	LG Electronics

8.1.8 Other

Including remaining evaluation assumptions
Including forward compatibility not covered by above agenda items

R1-1610880 Chairman's notes of AI 8.1.8 Ad-Hoc chair (Qualcomm)

The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is endorsed and content incorporated below.

R1-1608857 Remaining issues on panel modeling Huawei, HiSilicon

Agreements:

- Phase offset of non-calibrated panel (either TRP or UE side) is modeled as a uniform distributed random variable between (-π, π).
- Adopt the accumulated phase offset of non-calibrated panel pair in channel coefficients equation (7.21) and (7.26) in TR 38.900.

R1-1608965 Initial Link Level Simulation Results for URLLC ZTE
R1-1609140 Remaining evaluation assumption for dense urban macro with 30GHz frequency Samsung

Agreements:

- When deploying macro TRP at above 6GHz in dense urban scenario,
  - 40dBm PA scaled down with simulation BW when system BW is higher than simulation BW.

R1-1609312 Remaining evaluation details of High Speed Train Scenario CMCC

Agreements:

- For High speed train scenario
  - The baseline BS antenna configuration at 4GHz in high speed train scenario is (M,N,P,Mg,Ng) =(8,8,2,1,1), where the radiation pattern of antenna elements follows TR 36.873 according to the current agreements. Other antenna configurations are not precluded.
  - For geometry evaluation, the users are uniformly distributed along the railway track. Companies provide geometry results to determine the azimuth beam direction using the beam formed by two elements with

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weighting values [1, 1] assuming no power loss and elevation downtilt angle using the DFT beam formed by all vertical elements for cell association.
  - Adopt the penetration loss model in Table 1 of R1-1609312 for high speed train scenario.

R1-1609545 Remaining details of URLLC system level evaluation assumptions Intel Corporation
R1-1610720 WF on URLLC System Level Evaluation Methodology Intel, Qualcomm, ZTE, ZTE Microelectronics

Agreements:
- Slide 3 and slide 4 in R1-1610720 are agreed with the following updates:
  - Option 1 for UE distribution on slide 4 is for DL only, optional, and 1 eMBB UE in the other 56 sectors is of the same traffic model as the eMBB UEs in the center sector
  - ~~o~~ Unidirectional and bidirectional (DL or UL) ~~is evaluated as baseline. Bidirectional DL and UL traffic is evaluated as a second priority.~~
  - URLLC: Both FTP Model 3 (with Poisson arrival) and periodic packet arrivals with packet size 32, 50, 200 bytes.
  - URLLC: P~~oisson p~~acket arrival ~~with arrival rate λ~~ to achieve URLLC capacity
  - For "Simulation bandwidth"
    - Add "other bandwidths are not precluded"
  - For eMBB UE of FTP model 3, add that the packet size is 0.1Mbytes and 0.5Mbytes
  - Companies are encouraged to report the power control parameters (e.g., open-loop, etc.) for UL URLLC evaluations

R1-1609546 On eMBB and URLLC multiplexing Intel Corporation
R1-1610436 Path loss model for evaluation of mMTC Ericsson (Revision of R1-1609775)
R1-1610183 Updated mMTC battery life evaluation assumptions Qualcomm Incorporated
R1-1610359 On the utilization of Advanced Receivers in NR Nokia, Alcatel-Lucent Shanghai Bell

R1-1610681 WF on coexistence between NR and LTE LG Electronics, AT&T
R1-1610800 WF on coexistence between NR and LTE LG Electronics, AT&T, Ericsson

Agreements:
- To support the efficient coexistence between NR and LTE operating in the same licensed frequency band,
  - At least legacy LTE features should be considered in the NR study, e.g.:
    - MBSFN configuration (for LTE Rel-8 and beyond)
    - TDD UL subframe (for LTE Rel-8 and beyond)
    - SCell activation/deactivation (for LTE Rel-10 and beyond)
    - TDD UL subframe configured by eIMTA feature (for LTE Rel-12 and beyond)
  - NR should study the following candidate mechanisms for coexistence:
    - Resource indication (e.g., blank resources, available resources, etc.) of time/frequency resources
    - Reconfiguring channel bandwidth/carriers monitored by UEs
    - Any other mechanisms are not precluded.
  - For non co-located LTE/NR case, backhaul signaling between LTE and NR can be studied to mitigate inter-cell interference.
    - FFS on which information can be conveyed on the backhaul signaling
    - Over-the-air listening at the gNB can also be considered
  - Note: Dynamic switch between NR and LTE can be studied from the perspective of network for co-located LTE/NR case.

R1-1610951 Way Forward on LLS evaluation assumption for control channel evaluation in URLLC Huawei, HiSilicon
The evaluation assumptions for control channel in URLLC are to be discussed under control channel design for URLLC

R1-1609774 Channel model for evaluation of Rural scenario Ericsson
R1-1610961 Way Forward on O2I model for rural scenario Huawei, HiSilicon, CATT, CATR, CMCC
R1-1610955 WF on channel model for Rural macro scenario Ericsson
Also supported by AT&T, Deutsche Telekom, Samsung, Intel
Email discussion/approval based on the above two WFs till Oct 21th (Kazuaki, DCM)

Not treated.
R1-1608843 Overview of URLLC support for NR Huawei, HiSilicon
R1-1608856 Further discussion on URLLC evaluation Huawei, HiSilicon
R1-1608960 Remaning issue on system level evaluation assumptions for URLLC ZTE

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R1-1609137 NR-LTE Coexistence Samsung
R1-1609138 Carrier Aggregation for NR Samsung
R1-1609139 Overview of NR Unlicensed Spectrum Samsung
R1-1609285 Forward compatibility issues considering NR operation in unlicensed spectrum LG Electronics
R1-1609286 On coexistence of NR and LTE LG Electronics
R1-1609287 Forward compatibility issues on mMTC LG Electronics
R1-1609434 Discussion on UE power consumption reduction in NR Huawei, HiSilicon
R1-1609447 Way Forward on Modeling Line-of-Sight Blockage for V2V Huawei, HiSilicon, Volkswagen, Ericsson, General Motors, Vodafone
R1-1609544 LTE/NR coexistence Intel Corporation
R1-1609620 On scrambling Ericsson
R1-1609633 On URLLC characteristics Ericsson
R1-1609634 On URLLC design principles Ericsson
R1-1609636 On NR Operation in the 60 GHz Unlicensed Band Ericsson
R1-1609637 On channel access mechanisms for NR in unlicensed spectrum Ericsson
R1-1609638 Technology components for unlicensed operation Ericsson
R1-1609639 On autonomous UL transmissions for NR in unlicensed spectrum Ericsson
R1-1609640 Discussion of multi-antenna and highly directional beam-forming for unlicensed operation Ericsson
R1-1609641 On Physical Layer Design Policies for Unlicensed Operation of NR Ericsson
R1-1609703 Antenna pattern at UE/RSU in NR eV2X Ericsson
R1-1609713 Discussions on simulation scenarios of NR eV2X at 63GHz Ericsson
R1-1609714 Discussions on traffic model for NR eV2X Ericsson
R1-1609753 Update to channel models for eV2X evaluation Ericsson
R1-1609781 Satellite Aspects- Forward Compatibility Consideration Dish Network
R1-1609802 Operation on high frequency band of unlicensed spectrum in NR ZTE
R1-1609803 Discussion on NR operation in unlicensed spectrum ZTE
R1-1609890 Requirements on Future Railway Mobile Communcation ZTE, China Academy of Railway Sciences (CARS), CATR
R1-1610091 In-band full duplexing in NR HTC Corporation
R1-1610109 NR and LTE coexistence assisted by embedded-GFDM National Taiwan University
R1-1610184 Summary of email discussion on mMTC evaluation path loss calibration Qualcomm Incorporated
R1-1610185 Remaining issue for mMTC evaluation assumption Qualcomm Incorporated
R1-1610186 Updated URLLC SLS evaluation assumptions Qualcomm Incorporated
R1-1610187 EMBB DL bursty data Qualcomm Incorporated
R1-1610188 URLLC system capacity and URLLC/eMBB multiplexing efficiency analysis Qualcomm Incorporated
R1-1610189 Summary of KP evaluation results for MMW scenarios Qualcomm Incorporated
R1-1610190 Impact of initial access design for access/backhaul relay Qualcomm Incorporated
R1-1610315 On battery models for mMTC Ericsson
R1-1610316 On the evolution of mMTC Ericsson
R1-1610360 On the cross-link interference mitigation Nokia, Alcatel-Lucent Shanghai Bell
R1-1610361 On network energy efficiency requirement and evaluation for the 5G new radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1610362 Uplink power control for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1610366 Discussion on URLLC design aspects Intel Corporation
R1-1610367 Considerations on eV2X NR design Intel Corporation
R1-1610368 Preliminary eV2X evaluation analysis Intel Corporation
R1-1610737 Support of URLLC in UL Huawei, HiSilicon

8.2 Other

Including channel model for frequency spectrum above 6 GHz

R1-1610881 Chairman's notes of AI 8.2 Ad-Hoc chair (Nokia)
The document was presented by Matthew Baker from Nokia.
Decision: The document is endorsed and content incorporated below.

Channel model TR38.900
R1-1609776 Correction for O-I modeling for RMa Ericsson
Decision: CR0045 to 38.900 (Rel-14) is agreed.
R1-1609796 TR38.900_CR_Section_7.5 Fraunhofer HHI
Decision: CR0046 to 38.900 (Rel-14) is agreed.
R1-1610479 TR38.900_CR_Section_7.6.2.2 Fraunhofer HHI (Revision of R1-1609797)
Decision: CR0047r1 to 38.900 (Rel-14) is agreed.

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R1-1610313 **Correction for correlation modelling for multi-frequency simulations** **Ericsson**
Decision: Revisit at RAN1#87. CR0051 to 38.900 (Rel-14) is postponed to next meeting.

R1-1609798 **TR38.900_CR_Section_7.7.1** **Fraunhofer HHI**
Decision: CR0048 to 38.900 (Rel-14) is agreed.
R1-1610225 **TR38.900_CR_Section_7.7.5.1** **Mitsubishi Electric Co., Fraunhofer HHI**
Decision: CR0050 to 38.900 (Rel-14) is agreed.
R1-1609799 **TR38.900_CR_Section_8.4** **Fraunhofer HHI**
Decision: CR0049 to 38.900 (Rel-14) is agreed.

Companies are invited to check the following late CRs before RAN1#87:
R1-1610699 TR38.900_CR_Azimuthal_Angle_Notation Fraunhofer HHI
Decision: CR0053 to 38.900 (Rel-14) is postponed to next meeting.
R1-1610700 TR38.900_CR_Harmonizing_Terminology Fraunhofer HHI
Decision: CR0054 to 38.900 (Rel-14) is postponed to next meeting.

R1-1609785 **e-mail discussion summary [86-28] on additional feature calibration** **Samsung**
R1-1610679 **38.900CR0052 to capture additional feature calibration results** **Samsung**
Decision: CR0052 to 38.900 (Rel-14) is agreed.

R1-1610688 Full calibration results for channel model above 6GHz Lenovo, Motorola Mobility

Other
R1-1609793 **TR25.996_CR_Equation_Numbering** **Fraunhofer HHI**
Decision: CR0002 to 25.996 (Rel-13) is agreed.
R1-1609794 **TR36.814_CR_Equation_Numbering** **Fraunhofer HHI**
Decision: CR0001 to 36.814 (Rel-9) is agreed.
R1-1609795 **TR36.873_CR_Equation_Numbering** **Fraunhofer HHI**
Decision: CR0005 to 36.873 (Rel-12) is agreed.

Companies are invited to check the following late CRs before RAN1#87:
R1-1610701 TR36.873_CR_Section_7.3 Fraunhofer HHI
Decision: CR0006 to 36.873 (Rel-12) is postponed to next meeting.
R1-1610702 TR36.873_CR_LOS_Probability Fraunhofer HHI
Decision: CR0007 to 36.873 (Rel-12) is postponed to next meeting.
R1-1610703 TR36.814_CR_Section_B.1.2.2.1 Fraunhofer HHI
Decision: CR0002 to 36.814 (Rel-9) is postponed to next meeting.
R1-1610704 TR36.814_CR_LOS_Probability Fraunhofer HHI
Decision: CR0003 to 36.814 (Rel-9) is postponed to next meeting.

9 Closing of the meeting

Mr Chair thanked all for the hard work during the week. Special thanks to Channel coding for NR team who finished Wednesday/Thursday sessions very late (01:30AM).
Thanks also to the European Friends of 3GPP for hosting and organizing meeting room facilities for such big meeting.
Mr Chair thanked Vice chairs and all the rapporteurs who help managing the number of parallel sessions during the course of the week.
Question was raised by Cohere Technologies regarding how Phase 2 for NR will be taken into account.
Mr Chair emphasized that the details remain a RAN plenary decision, and if clarification is needed, this should be discussed by December 2016.
Agenda to next upcoming meetings shall slightly changed compare to the one of RAN1#86bis.
Huawei commented that reviewing the NR TR content during the meeting was made very difficult due to the work load all week long – better to update between meetings – NTT DOCOMO responded that the draft TR was distributed and available one week prior to RAN1#86bis.
Meeting was closed at 17:07.
See you all in Reno.

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Annex A: List of Tdocs at RAN1 #86bis

Please see excel file attached to this report

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Annex B: List of CRs agreed at RAN1 #86bis

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TS	CR	Rev	Rel	Title	Cat	Vsn	@ Mtg	TD#	Source to WG	Work Item
25.212	344	-	Rel-14	Introduction of HS-SCCH Order for HS-SCCH DRx feature in enhanced Cell Fach	B	13.1.0	R1#86b	R1-1609782	Qualcomm Europe Inc.(France)	FACH_DTXDRX-Core
25.214	758	-	Rel-14	UE Procedures for HS-SCCH DRx feature in enhanced Cell Fach	B	13.4.0	R1#86b	R1-1609784	Qualcomm Europe Inc.(France)	FACH_DTXDRX-Core
36.211	289	-	Rel-13	Correction to DMRS for MPDCCH associated with P-RNTI	F	13.3.0	R1#86b	R1-1609605	Virtuosys Ltd, Qualcomm Incorporated, Intel Corporation	LTE_MTCe2_L1-Core
36.211	291	1	Rel-13	Correction on MPDCCH transmission without repetition	F	13.3.0	R1#86b	R1-1610778	Huawei, HiSilicon	LTE_MTCe2_L1-Core
36.211	295	-	Rel-13	Correction of typos due to wrong implementation of CR0283 "Clarification of valid subframe in eMTC"	D	13.3.0	R1#86b	R1-1610439	MCC	LTE_MTCe2_L1-Core
36.211	296	-	Rel-13	Correction on NZP CSI-RS aggregation for Class A	F	13.3.0	R1#86b	R1-1610451	LG Electronics, Samsung	LTE_EBF_FDMIMO-Core
36.211	297	-	Rel-14	Draft CR on start timing of PUSCH	F	14.0.0	R1#86b	R1-1610475	Samsung	LTE_eLAA-Core
36.211	298	-	Rel-14	Correction to DMRS for MPDCCH associated with P-RNTI - Rel-14	A	14.0.0	R1#86b	R1-1610504	Virtuosys Ltd, Qualcomm Incorporated, Intel Corporation	LTE_MTCe2_L1-Core
36.211	299	-	Rel-13	Clarification on NPRACH and NPUSCH collision	F	13.3.0	R1#86b	R1-1610505	Qualcomm Incorporated	NB_IoT-Core
36.211	300	-	Rel-14	Clarification on NPRACH and NPUSCH collision	A	14.0.0	R1#86b	R1-1610506	Qualcomm Incorporated	NB_IoT-Core
36.211	301	-	Rel-13	Clarification on i_0 value	F	13.3.0	R1#86b	R1-1610911	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.211	302	-	Rel-14	Clarification on i_0 value	A	14.0.0	R1#86b	R1-1610912	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.211	303	-	Rel-13	Correction of PRACH starting subframes for eMTC	F	13.3.0	R1#86b	R1-1610914	Intel Corporation, Ericsson	LTE_MTCe2_L1-Core
36.211	304	-	Rel-14	Correction of PRACH starting subframes for eMTC	A	14.0.0	R1#86b	R1-1610915	Intel Corporation, Ericsson	LTE_MTCe2_L1-Core
36.211	305	-	Rel-13	Correction of NPRACH frequency hopping	F	13.3.0	R1#86b	R1-1610916	Intel Corporation	NB_IOT-Core
36.211	306	-	Rel-14	Correction of NPRACH frequency hopping	A	14.0.0	R1#86b	R1-1610917	Intel Corporation	NB_IOT-Core
36.211	307	-	Rel-14	Correction on MPDCCH transmission without repetition	A	14.0.0	R1#86b	R1-1610926	Huawei, HiSilicon	LTE_MTCe2_L1-Core
36.211	308	-	Rel-14	Correction of typos due to wrong implementation of CR0283 "Clarification of valid subframe in eMTC"	A	14.0.0	R1#86b	R1-1611020	MCC, Qualcomm	LTE_MTCe2_L1-Core
36.212	221	-	Rel-14	Corrections to RV in eLAA DCI definitions	F	14.0.0	R1#86b	R1-1610459	Nokia, Alcatel-Lucent Shanghai Bell	LTE_eLAA-Core
36.212	222	-	Rel-14	Draft CR on DCI formats related with LAA in TS 36.212	D	14.0.0	R1#86b	R1-1610476	ETRI	LTE_eLAA-Core
36.212	223	-	Rel-14	Clarification of PUSCH start position for eLAA	F	14.0.0	R1#86b	R1-1610886	Panasonic, Qualcomm Incorporated	LTE_eLAA-Core

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36.212	224	0	Rel-14	Draft CR on RI transmission on PUSCH for LAA SCells	F	14.0.0	R1#86b	R1-1610998	Qualcomm Incorporated	LTE_eLAA-Core
36.213	746	-	Rel-13	Correction on the determination of NPDCCH candidates	F	13.3.0	R1#86b	R1-1609403	ITRI	NB_IoT-Core
36.213	747	-	Rel-14	Correction on the determination of NPDCCH candidates	A	14.0.0	R1#86b	R1-1609404	ITRI	NB_IoT-Core
36.213	749	2	Rel-13	Correction on downlink power allocation for SC-PTM	F	13.3.0	R1#86b	R1-1611045	TD Tech, Huawei	LTE_SC_PTM-Core
36.213	751	1	Rel-13	CR on 36.213 NB-IoT Type1 and Type 2 search space definition	F	13.3.0	R1#86b	R1-1610733	Ericsson	NB_IoT-Core
36.213	752	1	Rel-14	CR on 36.213 NB-IoT Type1 and Type 2 search space definition	A	14.0.0	R1#86b	R1-1610734	Ericsson	NB_IOT-Core
36.213	754		Rel-13	Correction on CWp adjustment on Type B1 multi-carrier access procedure for Rel-13 LAA	F	13.3.0	R1#86b	R1-1610450	WILUS Inc.	LTE_LAA-Core
36.213	755	-	Rel-13	Correction to PUCCH reporting mode 2-1	F	13.3.0	R1#86b	R1-1610452	Intel Corporation, ZTE Corporation, ZTE Microelectronics	LTE_EBF_FDMIMO-Core
36.213	756	-	Rel-13	Correction to PUCCH reporting mode 1-1	F	13.3.0	R1#86b	R1-1610453	Intel Corporation, ZTE Corporation, ZTE Microelectronics	LTE_EBF_FDMIMO-Core
36.213	757	-	Rel-14	Correction to PUCCH reporting mode 2-1	A	14.0.0	R1#86b	R1-1610454	Intel Corporation, ZTE Corporation, ZTE Microelectronics	LTE_EBF_FDMIMO-Core
36.213	758	-	Rel-14	Correction to PUCCH reporting mode 1-1	A	14.0.0	R1#86b	R1-1610455	Intel Corporation, ZTE Corporation, ZTE Microelectronics	LTE_EBF_FDMIMO-Core
36.213	759	_	Rel-14	Correction on UL grant reception in ending partial subframe	F	14.0.0	R1#86b	R1-1610456	LG Electronics	LTE_eLAA-core
36.213	760	_	Rel-14	Correction on UL burst scheduling	F	14.0.0	R1#86b	R1-1610457	LG Electronics	LTE_eLAA-core
36.213	761	-	Rel-14	Draft CR on PHICH operation for eLAA in 36.213	F	14.0.0	R1#86b	R1-1610458	Huawei, HiSilicon	LTE_LAA-Core
36.213	762		Rel-14	Correction on handling UL LBT procedure under UE power limited case	F	14.0.0	R1#86b	R1-1610460	WILUS Inc.	LTE_eLAA-core
36.213	763	-	Rel-13	Clarification on spectral efficiency	F	13.3.0	R1#86b	R1-1610493	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.213	764	2	Rel-13	Aperiodic CSI without MPDCCH frequency hopping	F	13.3.0	R1#86b	R1-1610944	Qualcomm Incorporated, Samsung	LTE_MTCe2_L1-Core
36.213	765	-	Rel-14	Clarification on spectral efficiency	A	14.0.0	R1#86b	R1-1610495	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.213	766	2	Rel-14	Aperiodic CSI without MPDCCH frequency hopping	A	14.0.0	R1#86b	R1-1610945	Qualcomm Incorporated, Samsung	LTE_MTCe2_L1-Core
36.213	767	1	Rel-13	Correction on equation for MPDCCH search space and starting subframe position	F	13.3.0	R1#86b	R1-1610796	NTT DOCOMO, Panasonic	LTE_MTCe2_L1-Core
36.213	768	1	Rel-14	Correction on equation for MPDCCH search space and starting subframe position	A	14.0.0	R1#86b	R1-1610797	NTT DOCOMO, Panasonic	LTE_MTCe2_L1-Core

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36.213	769	-	Rel-13	Clarification of number of repetitions of PUCCH	F	13.3.0	R1#86b	R1-1610648	ZTE, Rohde & Schwarz	LTE_MTCe2_L1-Core
36.213	770	-	Rel-13	Clarification on nrs-Power related description	F	13.3.0	R1#86b	R1-1610649	ZTE	NB_IoT-Core
36.213	771	-	Rel-14	Clarification of number of repetitions of PUCCH	A	14.0.0	R1#86b	R1-1610656	ZTE, Rohde & Schwarz	LTE_MTCe2_L1-Core
36.213	772	-	Rel-14	Clarification on nrs-Power related description	A	14.0.0	R1#86b	R1-1610657	ZTE	NB_IoT-Core
36.213	773		Rel-14	Removal of LAA DRS channel access from UL Type 2 Channel Access description	F	14.0.0	R1#86b	R1-1610884	Nokia, Alcatel-Lucent Shanghai Bell	LTE_eLAA-core
36.213	774	-	Rel-14	CR on UL duration and offset field in TS 36.213	D	14.0.0	R1#86b	R1-1610896	ETRI	LTE_eLAA-Core
36.213	775		Rel-14	Correction on channel access priority class according to UL LBT type indication in eLAA	F	14.0.0	R1#86b	R1-1610900	WILUS Inc.	LTE_eLAA-core
36.213	776	1	Rel-14	Correction on periodic CSI transmission	F	14.0.0	R1#86b	R1-1611007	LG Electronics	LTE_eLAA-core
36.213	778	-	Rel-14	Draft CR on UL CWS adjustment for eLAA in 36.213	F	14.0.0	R1#86b	R1-1611022	Huawei, HiSilicon, Qualcomm, Broadcom, LGE, Ericsson, Intel,	LTE_eLAA-core
36.213	779	0	Rel-14	CR on trigger monitoring timeline for triggered grants in eLAA	F	14.0.0	R1#86b	R1-1611025	Qualcomm Incorporated	LTE_eLAA-Core
36.213	780	_	Rel-13	Correction on CSI reference resource definition in LAA	F	13.3.0	R1#86b	R1-1611027	LG Electronics	LTE_LAA-Core
36.213	781	_	Rel-14	Correction on CSI reference resource definition in LAA	A	14.0.0	R1#86b	R1-1611028	LG Electronics	LTE_eLAA-core
36.213	782	_	Rel-13	Correction on CSI measurement in LAA	F	13.3.0	R1#86b	R1-1611029	LG Electronics	LTE_LAA-Core
36.213	783	_	Rel-14	Correction on CSI measurement in LAA	A	14.0.0	R1#86b	R1-1611030	LG Electronics	LTE_eLAA-core
36.214	39	-	Rel-13	Correction on SSTD definition	F	13.3.0	R1#86b	R1-1608717	CATT	LTE_SC_enh_dualC-Core
36.214	40	-	Rel-14	Correction on SSTD definition	A	14.0.0	R1#86b	R1-1609824	CATT	LTE_SC_enh_dualC-Core
36.213	0748	-	Rel-14	Introduction of RACHless handover for Further mobility enhancement in LTE	B	14.0.0	R1#86b	R1-1609552	ZTE Corporation, Intel	LTE_eMob-Core
36.213	0753	_	Rel-13	Correction on PDCCH candidate configuration	F	13.3.0	R1#86b	R1-1611074	Nokia, Alcatel-Lucent Shanghai Bell	LTE_CA_enh_b5c
36.213	0784	_	Rel-14	Correction on PDCCH candidate configuration	F	14.0.0	R1#86b	R1-1611072	LG Electronics	LTE_eLAA-core

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TS	CR	Rev	Rel	Title	Cat	Vsn	@ Mtg	TD#	Source to WG	Work Item
25.996	2		Rel-13	TR25.996_CR_Equation_Numbering	D	13.0.0	R1#86b	R1-1609793	Fraunhofer HHI	MIMO
36.814	1		Rel-9	TR36.814_CR_Equation_Numbering	D	9.0.0	R1#86b	R1-1609794	Fraunhofer HHI	FS_RAN_LTEA
36.873	5		Rel-12	TR36.873_CR_Equation_Numbering	D	12.2.0	R1#86b	R1-1609795	Fraunhofer HHI	FS_LTE_3D_channel
38.900	45	-	Rel-14	Correction for O-I modeling for RMa	F	14.1.0	R1#86b	R1-1609776	Ericsson	FS_6GHz_CH_model
38.900	46		Rel-14	TR38.900_CR_Section_7.5	F	14.1.0	R1#86b	R1-1609796	Fraunhofer HHI	FS_6GHz_CH_model
38.900	47	1	Rel-14	TR38.900_CR_Section_7.6.2.2	F	14.1.0	R1#86b	R1-1610479	Fraunhofer HHI, Samsung, Ericsson, Intel, Nokia, InterDigital	FS_6GHz_CH_model
38.900	48		Rel-14	TR38.900_CR_Section_7.7.1	F	14.1.0	R1#86b	R1-1609798	Fraunhofer HHI	FS_6GHz_CH_model
38.900	49		Rel-14	TR38.900_CR_Section_8.4	D	14.1.0	R1#86b	R1-1609799	Fraunhofer HHI	FS_6GHz_CH_model
38.900	50	-	Rel-14	TR38.900_CR_Section_7.7.5.1	F	14.1.0	R1#86b	R1-1610225	Mitsubishi Electric, Fraunhofer HHI	FS_6GHz_CH_model
38.900	52	-	Rel-14	CR to capture additional feature calibration results	F	14.1.0	R1#86b	R1-1610679	Samsung	FS_6GHz_CH_model

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Annex C-1: List of Outgoing LSs from RAN1 #86bis

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1610571	LS reply on Multi-carrier enhancements for UMTS	RAN1, Ericsson	Rel-14	UTRA_MCe-Core	R1-168089	RAN2, RAN3			
R1-1610572	LS to RAN2/3 on RAN1 progress on MC enhancements	RAN1, Huawei	Rel-14	UTRA_MCe-Core		RAN2, RAN3			
R1-1610655	LS on wider bandwidth operation for NR	RAN1, NTT DOCOMO	Rel-14	FS_NR_newRAT		RAN4	RAN2		
R1-1610780	LS on power allocation for SC-PTM	RAN1, Huawei	Rel-13	LTE_SC_PTM-Core		RAN2			
R1-1610929	LS response on DFN offset	RAN1, Ericsson	Rel-14	LTE_V2X-Core	R1-1610798	RAN2			
R1-1610930	LS response on Exceptional Pool Handling for V2X	RAN1, Ericsson	Rel-14	LTE_SL_V2V-Core	R1-1608566	RAN2			
R1-1610992	LS on NR RACH Procedure	RAN1, Huawei	Rel-14	FS_NR_newRAT		RAN2			
R1-1611000	LS on V2X UE transmission chain	RAN1, Huawei	Rel-14	LTE_V2X-Core		RAN2, RAN4			
R1-1611026	Reply LS on CSI measurement ambiguity in LAA	LG Electronics	Rel-13	LTE_LAA-Perf	R1-1608572	RAN4			
R1-1611031	Response LS to IEEE 802.11 regarding LAA	RAN1, Qualcomm	Rel-13	LTE_LAA-Core	R1-167908	IEEE 802 LAN/MAN Standards Committee	"Wi-Fi Alliance, The City of New York Office of the Mayor, RAN, RAN2, RAN4		
R1-1611032	LS on configuration of NPRS power for NB-IoT downlink positioning	RAN1, Huawei	Rel-14	NB_IOTenh-Core	"				
R1-1611033	LS on SC-MCCH transmission in NB-IoT	RAN1, HiSilicon	Rel-14	NB_IOTenh-Core, LTE_feMTC-Core		RAN4			
R1-1611034	LS on collisions between SC-PTM and Paging in NB-IoT	RAN1, HiSilicon	Rel-14	NB_IOTenh-Core		RAN2			
R1-1611049	LS for SRS Carrier-Based Switching Agreements	RAN1, Huawei	Rel-14	LTE_SRS_switch-Core		RAN2, RAN3, SA2			
R1-1611050	LS on L1 parameters for Carrier-Based Switching	RAN1, Huawei	Rel-14	LTE_SRS_switch-Core		RAN2, RAN4			
R1-1611051	LS regarding agreements for FeMBMS	RAN1, Qualcomm	Rel-14	MBMS_LTE_enh2-Core		RAN2	RAN4		
R1-1611052	LS on Multipath RSTD reporting and CRS usage together with PRS	RAN1, Ericsson, Intel	Rel-14	UTRA_LTE_iPos_enh2-Core		RAN2			
R1-1611053	LS on FeMTC VoLTE enhancements	RAN1, Huawei	Rel-14	LTE_feMTC-Core		RAN2	RAN3, RAN4		
R1-1611054	LS on implication of sTTI operation on UL ON/OFF time mask	RAN1, Ericsson	Rel-15	LTE_sTTIandPT-Core		RAN2, RAN4			

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1611055	LS On Shortened TTI and processing time for LTE	RAN1, Ericsson	Rel-15	LTE_sTTIandPT-Core		RAN4			
R1-1611056	Reply LS on A New PRACH Cyclic Shift Restriction Set	RAN1, Huawei	Rel-14	LTE_high_speed-Core		RAN2, RAN4			
R1-1611057	LS for Voice and Video enhancement for LTE	RAN1, Huawei	Rel-14	LTE_VoLTE_ViLTE_enh-Core	R1-163371	RAN4, RAN2			
R1-1611066	LS on RAN1 agreements potentially related to RAN2/4 in LTE-based V2X services	RAN1, LGE	Rel-14	LTE_V2X-Core		RAN2			

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Annex C-2: List of Incoming LSs from RAN1 #86bis

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1608564	LS Response on QoS requirements for V2X	RAN2, Intel	Rel-14	LTE_SL_V2V-Core	S2-163081	SA1, SA2	RAN1, RAN3	R2-165773	
R1-1608565	LS on Support of CAT 9/10 and CAT 13	RAN2, Intel	Rel-12	TEI12		RAN1		R2-165924	
R1-1608566	LS on Exceptional Pool Handling for V2X	RAN2, OPPO	Rel-14	LTE_SL_V2V-Core		RAN1		R2-165962	
R1-1608567	LS on Timing reference for LAA SCell	RAN2, LGE	Rel-14	LTE_eLAA-Core		RAN4	RAN1	R2-165965	
R1-1608568	LS on further mobility enhancements	RAN2, ZTE	Rel-14	LTE_eMob-Core		RAN1, RAN3, RAN4		R2-165969	
R1-1608569	LS on RAN2 agreements on FeMBMS	RAN2, Qualcomm	Rel-14	MBMS_LTE_enh2-Core		RAN WG1		R2-165970	
R1-1608570	Reply LS on ECID positioning for TDD	RAN2, CATT	Rel-13	TEI13	R1-161518	RAN1, RAN3, RAN4	RAN5	R2-165974	
R1-1608571	LS on introduction of new UL categories in Rel-13	RAN2, Qualcomm	Rel-13	TEI13		RAN	RAN1	R2-165975	
R1-1608572	LS on CSI measurement ambiguity in LAA	RAN4, LGE	Rel-13	LTE_LAA-Perf		RAN1		R4-165659	
R1-1608573	Response LS on Modelling and simulation of IMT networks for use in sharing and compatibility studies	RAN4, Ericsson	Rel-14	FS_NR_newRAT	LS_EOs_5D_234_temp_125R1	RAN	RAN1	R4-166674	
R1-1608574	LS on Characteristics of terrestrial IMT systems for frequency sharing/interference analysis in the frequency range between 24.25 GHz and 86 GHz	RAN4, Nokia	Rel-14	FS_NR_newRAT	RP-160508	RAN	RAN1	R4-166734	
R1-1608575	Reply LS on blind detection evaluations	RAN4, MediaTek	Rel-14	LTE_MUST		RAN1		R4-166811	
R1-1608576	Reply LS on the feasibility of mobility enhancement solutions	RAN4, Ericsson, ZTE	Rel-14	LTE_eMob-Core	R2-163135, R2-164565	RAN2	RAN1, RAN3	R4-166817	
R1-1608577	Reply LS on SRS carrier switching interruption time	RAN4, Huawei	Rel-14	LTE_SRS_switch-Core	R1-163453	RAN1		R4-166913	
R1-1608578	LS on Measurement gap enhancement	RAN4, Ericsson, Intel	Rel-14	LTE_meas_gap_enh-Core		RAN2	RAN1	R4-167024	
R1-1608579	LS for definition of SSTD measurement	RAN4, CATT	Rel-12	LTE_SC_enh_dualC		RAN1	RAN2, RAN5	R4-167153	
R1-1608580	LS on on UCG parameters for eMTC	RAN4, Intel	Rel-13	LTE_MTCe2_L1-Core		RAN1, RAN2		R4-167198	

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1608581	LS on LTE Rel-13 UE feature list	RAN4, Qualcomm, Intel	Rel-13			RAN2	RAN, RAN1	R4-167200	
R1-1608582	Reply LS on QoS requirements for V2X	SA2, LGE	Rel-14	LTE_SL_V2V-Core	R2-165773	RAN2	SA1, RAN1, RAN3	S2-164913	
R1-1608583	Reply LS on NR requirements	RAN, ZTE	Rel-14	FS_NG_SReq	R2-165967	RAN2	RAN1	RP-161916	
R1-1610565	LS on Multi-carrier enhancements for UMTS	RAN2, Ericsson	Rel-14	UTRA_MCe-Core		RAN4	RAN1	R2-167169	
R1-1610680	LS on TTI switching for MC enhancements	RAN2, Huawei	Rel-14	UTRA_MCe-Core		RAN1, RAN3		R2-167171	
R1-1610765	LS on RAN2 agreements on FeMBMS	RAN2, Ericsson	Rel-14	MBMS_LTE_enh2-Core		RAN1		R2-167204	
R1-1610766	LS to RAN1 on V2V agreements	RAN2, LGE	Rel-14	LTE_SL_V2V-Core		RAN1		R2-167188	
R1-1610798	LS on DFN offset	RAN2, Huawei	Rel-14	LTE_V2X-Core		RAN1		R2-167189	

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Annex D: List of Approved updated WIDs

None

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Annex E: List of draft TSs/TRs agreed at RAN1 #86bis

Tdoc Number	Title	Source	Conclusion/Decision
R1-1610848	TR 38.802 v0.3.0 Study on New Radio (NR) Access Technology - Physical Layer Aspects	NTT DOCOMO, INC.	Endorsed

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Annex F: List of actions

- **Outgoing LS.**

None

- **CR approval**

[86b-04] Zhisong (ZTE)
R1-1609552 **Introduction of RACHless handover for Further mobility enhancement in LTE** **ZTE Corporation**
CR0748 to 36.213 (Rel-14) is for email approval until October 20th
Done: According to Mr Chair's decision posted on October 21st, CR0748 to 36.213 (Rel-14) is agreed.

[86b-03] Seonwook (LGE)
R1-1610852 **Correction on PDCCH candidate configuration** **LG Electronics** **36.213 (Rel-13)**
R1-1610853 **Correction on PDCCH candidate configuration** **LG Electronics** **36.213 (Rel-14)**
Email approval for R1-1610852 and R1-1610853 till 21st Oct.
Done: According to Mr Chair's decision posted on October 26th (resp. November 1st), CRs to 36.213 are agreed as follows:
R1-1611072 **Correction on PDCCH candidate configuration** **LG Electronics** **Rel-14** **LTE_eLAA-Core** **CR0784 F**
R1-1611074 **Correction on PDCCH candidate configuration** **Nokia, Alcatel-Lucent Shanghai Bell** **Rel-13** **LTE_CA_enh_b5c-Core** **CR0753 F**

[86b-05] Editors
MUST CRs
Editors (36.201, 211, 212, 213, 214) will provide draft CRs including agreements and WA until 10th Nov. (Thu)
Rapporteur will provide agreements list until 17th Oct.
All proponents are recommended to check the CRs until the next meeting
Done: List of agreements provided by rapporteur as
R1-1611070 **Summary of RAN1 Agreements for Rel-14 DL MUST** **MediaTek**

[86b-06] Editors
Further indoor positioning enh. CRs
Editors (36.201, 211, 212, 213, 214) will provide draft CRs including agreements and WA until 10th Nov. (Thu)
Rapporteur will provide agreements list until 17th Oct.
All proponents are recommended to check the CRs until the next meeting
Done: List of agreements provided by rapporteur as
R1-1611069 **Summary of RAN1 agreements for Rel-14 Further Indoor Positioning** **Huawei, HiSilicon, NextNav**

[86b-07] Editors

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SRS carrier based switching CRs
Editors (36.201, 211, 212, 213, 214) will provide draft CRs including agreements and WA until 10th Nov. (Thu)
Rapporteur will provide agreements list until 17th Oct.
All proponents are recommended to check the CRs until the next meeting
Done: List of agreements provided by rapporteur as
R1-1611067 List of agreements for "SRS Carrier-Based Switching" Huawei

[86b-08] Editors
High speed CRs
Editors (36.201, 211, 212, 213, 214) will provide draft CRs including agreements and WA until 10th Nov. (Thu)
Rapporteur will provide agreements list until 17th Oct.
All proponents are recommended to check the CRs until the next meeting
Done: List of agreements provided by rapporteur as
R1-1611068 Summary of RAN1 agreements for Rel-14 work item on 'Performance enhancements for high speed scenario' Huawei, HiSilicon, NTT DOCOMO

- **Text proposal for TS and TR**

None

- **Miscellaneous**

[86b-01] Peter (Qualcomm)
R1-1610413 Introduction of new Transport Block Size for DL 256QAM Qualcomm
Email approval until Oct. 27th.
Done: As a conclusion of this email thread, Mr Chair asked for a discussion summary being submitted at next RAN1#87 meeting.

[86b-02] Peter (Qualcomm)
R1-1610094 Clarification on a few PUCCH format 4 and 5 related issues in eCA Qualcomm Incorporated
The 1st and 3rd issues are for email discuss till Oct. 21st
Done: As a conclusion of this email thread, Mr Chair asked for a discussion summary being submitted at next RAN1#87 meeting.

[86b-09] Hoondong (Samsung)
Quantized Advanced CSI Feedback Structure for eFD-MIMO for email discussion considering the two proposals and any possible refinement/updates/merging (including R1-1611018), until 27th October
Done: According to Mr Chair's email posted on October 28th, the following is agreed:
- **For advanced CSI feedback, at least one of the following types of beam group is supported**
  - **Type 1: Class A based W1 (non-orthogonal)**
  - **Type 2: Unrestricted orthogonal W1**

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  - **Type 3: Orthogonal beams with restricted beam pattern**
- **For advanced CSI feedback, RAN1 will specify only rank-1 and rank-2 codebooks**
  - **FFS, rank 3-4**
  - **Note: For rank 5-8, Rel.13 codebooks, as well as the extension and/or enhancement to more than 16 ports, can be reused**

[86b-10] Jonghyun (LGE)
QCL issue for aperiodic CSI-RS for eFD-MIMO for email discussion until Oct. 20th
Done: According to Mr Chair's email posted on October 28th, the following is agreed:

- **For QCL indication on DMRS to aperiodic NZP CSIRS, until RAN1#87 decide first in TM10 whether aperiodic NZP CSIRS can be configured with UEs configured with QCL Type B. Note aperiodic NZP CSIRS can be configured with UEs configured with QCL Type A. For UEs configured with QCL Type B (if supported), down-select between**
  - **Alt.1: UE is not expected that aperiodic NZP CSIRS is indicated in PQI for QCL purpose with DMRS**
  - **Alt.2: Aperiodic NZP CSIRS can be indicated in PQI for QCL purpose, and follow legacy QCL assumption. Note: Periodic NZP CSI-RS can also be indicated for QCL purpose.**
- **For QCL indication on DMRS to 'multi-shot' NZP CSIRS, until RAN1#87 decide first in TM10 whether NZP CSI-RS activation/deactivation can be configured with UEs configured with QCL Type B. Note NZP CSI-RS activation/deactivation can be configured with UEs configured with QCL Type A. For UEs configured with QCL Type B (if supported), down-select between**
  - **Alt.1: UEs configured with NZP CSI-RS activation/deactivation do not expect that NZP CSIRS that is activated/deactivated is indicated in PQI for QCL purpose with DMRS**
  - **Alt.2: NZP CSIRS configured for activation/deactivation can be indicated in PQI for QCL purpose, and follow legacy QCL assumption. Note: NZP CSI-RS not configured for activation/deactivation can also be indicated for QCL purpose.**

[86b-11] Jonghyun (LGE)
Remaining details on PDSCH rate matching for eFD-MIMO for email discussion until Oct. 20th
Done: Summary document describing the following three rate matching alternatives identified for down-selection or merging until next meeting shall be submitted as input to RAN1#87:

Alt.1: Common-DCI based
Alt.3: 2-bit UE-specific DCI based
Alt.3': 2-bit UE-specific DCI based with MAC CE activation

[86b-12] Siva (Ericsson)
Aperiodic CSI-RS selection for eFD-MIMO for email discussion until Oct. 27th
Done: The following alternatives for Aperiodic CSI-RS resource selection are to be further discussed for down-selection until RAN1#87:

Alternative 1: Reuse A-CSI request field and add more bit(s) if necessary
Alternative 2: Reuse CS field
Alternative 3a: Introduce a new DCI field with ceil(log2(N)) additional bits

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Alternative 3b: Introduce a new DCI field with 2 additional bits
Summary document shall be submitted to next meeting.

[86b-13] Yuichi (DOCOMO)
Hybrid CSI Mechanism for eFD-MIMO for email discussion until Oct. 20th
Done: No conclusion according to Chair's email on Oct 25th – Continue discussion @RAN1#87.

[86b-14] Youngwoo (Samsung)
PUSCH CSI reporting for hybrid CSIRS mechanism 1 for eFD-MIMO for email discussion until Oct. 27th
Done: Following Chair's email posted on October 28th, the conclusion is:
Two alternatives to be down-selected in RAN1#87:

- **Alt1.: Proposal in R1-1610731**
  - **For aperiodic CSI reporting for hybrid CSI-RS mechanism 1**
    - **Either one of CSI for 1st eMIMO-Type (i.e., 1st CSI) and CSI for 2nd eMIMO-Type (i.e., 2nd CSI) is triggered for aperiodic CSI reporting**
  - **CSI request field in UL grant DCI is used to indicate either one of the two. FFS on number of bits**
    - **For 1st eMIMO-Type, encoding mechanism/mapping on PUSCH is FFS.**
    - **For 2nd eMIMO-Type, legacy CSI encoding/mapping on PUSCH is reused.**
    - **FFS: support of eCA**
- **Alt2.: Report both eMIMO-Types, but the UE is only required to update one of the two eMIMO-Types**
  - **Example a: A method analogous to Rel.13 CSI relaxation**
  - **Example b: cf. R1-1609853 section 2.2.2. For this solution, the reference resource definition for the 1st eMIMO-Type needs to be changed.**
  - **[R1-1609853] "When periodic CSI is not configured for the first eMIMO-Type, its reference resource is in the subframe containing its most recent CSI-RS resource**
  - **Otherwise, the reference resource for the first eMIMO-Type is that set by periodic CSI"**
  - **Note: This alternative does not preclude UE's CSI updates on both eMIMO-Types**

[86b-15] Hao (ZTE)
eMIMO-Types for eFD-MIMO for email discussion until 27th Oct.
Done: Following Chair's email posted on October 28th, the following is agreed:
Agreement for mechanism 1:

- **A UE can be simultaneously configured with both A-CSI and P-CSI**
- **For both A-CSI and P-CSI reporting, UE calculates CSI for only one eMIMO-Type of a pair at a time**
- **Support A-CSI (PUSCH-based) reporting for both 1st and 2nd eMIMO-Typesbased on the following joint configuration approach**
  - **Only the A-CSI reporting mode of the 2nd eMIMO-Type is configured, whereas the reporting content of the 1st eMIMO-Type (i1 and RI) is fixed**
    - **A-CSI configuration does not apply to the content of the 1st eMIMO-Type**
  - **Details about triggering to be decided in RAN1#87 (discussed in Youngwoo's [86b-14])**

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- **In RAN1#87, decide the need for supporting (and, if supported, the details of) at least one of the following combinations where CSI reporting modes for 1st and 2nd eMIMO-Types are independently configured.**
  - **'P' and 'A' refers to periodic and aperiodic CSI reporting for an eMIMO-Type**

Combination	1	2	3
1st eMIMO-Type	P	A	P and/or A
2nd eMIMO-Type	A	P	P and/or A

- **If combination 1 is supported, down-select from the following options**
  - **Opt-1: Use legacy CSI reporting configuration for the 1st eMIMO-Type**
  - **Opt-2: Both the A-CSI and P-CSI parameters are configured for the 2nd eMIMO-Type, and UE only reports A-CSI.**

[86b-16] Olof (Ericsson)
TBS/N_SF and TBS/N_RU tables for eNB-IoT for email discussion until 21st October
Done: New TBS tables for NB-IoT are agreed, according to Mr Chair's email decision posted on October 22nd. The tables are in:
R1-1611073 New Transport Block Size (TBS) tables for Rel-14 NB-IoT Ericsson

[86b-17] Wang Yi (Huawei)
LLS and SLS simulation results for NR MA
Email approval until 21st Oct.
Done: All results provided in this thread shall be sumarized and presented to RAN1#87 meeting.

[86b-18] Joseph (Qualcomm)
R1-1611059 Way Forward on Data Sharing Qualcomm
Email discussion until October 20th
Done: According to Mr Chair's email (October 29th), it is agreed that no central location is needed for sharing simulation results on channel coding. Based on data provided by intrested companies, moderator (InterDigital) should submit all data by Nov. 13th together with the summary in the same tdoc, with the rule of attaching an excel sheet in the same contribution. The summary shall only contain the collected data from all relevant contributions.
It was also suggested that companies should use CRC overhead (equivalent FAR as LTE. Turbo uses 24 CRC bits) and provide a fair comparison between all codes when false alarm rates are the same for all codes. This is critical at short block region.

[86b-19] Ruyue (ZTE)
NR MIMO calibration for email discussion until Oct. 28th
Done: As a conclusion of this email thread, Mr Chair asked for a discussion summary being submitted at next RAN1#87 meeting.

[86b-20] David (Huawei)
Synchronization and carrier rasters for NR for email discussion until Nov. 7th
Done: Status to be checked in RAN1#87.

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[86b-21] Stefan (Ericsson)
DL L1/L2 cont. channel design for NR for email discussion until Nov. 7th
Done: Status to be checked in RAN1#87.

[86b-22] Stefan (Ericsson)
UL L1/L2 cont. channel design for NR for email discussion until Nov. 7th
Done: Status to be checked in RAN1#87.

[86b-23] David (Huawei)
R1-1611036 **WF on DL control channel design** **Huawei, HiSilicon**
Email discussion until Nov. 7th
Done: Status to be checked in RAN1#87.

[86b-24] Kazuaki (DOCOMO)
Channel model for NR
Email discussion/approval until 21th Oct..
Done: No conclusion according to Chair's email on Nov 1st – Continue discussion @RAN1#87.

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Annex G: List of participants at RAN1 #86bis

Please see excel file attached to this report

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Annex H: **TSG RAN WG1 meetings in 2016 – 2017**

TITLE	TYPE	DATES	LOCATION	CTRY
3GPPRAN1#87	WG	14 – 18 Nov 2016	Reno	US
3GPPRAN1-NR	AH	16 – 20 Jan 2017	TBD	US
3GPPRAN1#88	WG	13 – 17 Feb 2017	Athens	Greece
3GPPRAN1#88bis	WG	03 – 07 Apr 2017	TBD	US
3GPPRAN1#89	WG	15 – 19 May 2017	TBD	China
3GPPRAN1-NR	AH	27 – 30 Jun 2017	TBD	China
3GPPRAN1#90	WG	21 – 25 Aug 2017	Prague (TBC)	Rep Czech
3GPPRAN1#90bis	WG	09 – 13 Oct 2017	Prague (TBC)	Rep Czech
3GPPRAN1#91	WG	27 Nov – 01 Dec 2017	TBD	US

MEETING TYPES	
AH = Ad Hoc	CM = Chairmen's meeting
JM = Joint	OR = Ordinary
PM = Preparatory Meeting	RG = Rapporteurs Group
RM = Resolution Meeting	SG = Steering Group
ST = Startup Meeting	TG = Task Group
WG = Working Group	XO = Extraordinary

End of document

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APPENDIX 22a

TDoc #	Title	Source	Contact	Contact ID	Type	Type supplement	For
R1-1608561	Draft Agenda of RAN1#86bis meeting	RAN1 Chair	Patrick Merias	52292	agenda		Approval
R1-1608562	Final Report of 3GPP TSG RAN1 #86 v1.0.0	ETSI	Patrick Merias	52292	report		Approval
R1-1608563	Selected highlights from RAN#73 of relevance to RAN1	RAN1 Chair	Patrick Merias	52292	other		Information
R1-1608564	LS Response on QoS requirements for V2X	RAN2, Intel	Patrick Merias	52292	LS in		
R1-1608565	LS on Support of CAT 9/10 and CAT 13	RAN2, Intel	Patrick Merias	52292	LS in		
R1-1608566	LS on Exceptional Pool Handling for V2X	RAN2, OPPO	Patrick Merias	52292	LS in		
R1-1608567	LS on Timing reference for LAA SCell	RAN2, LGE	Patrick Merias	52292	LS in		
R1-1608568	LS on further mobility enhancements	RAN2, ZTE	Patrick Merias	52292	LS in		
R1-1608569	LS on RAN2 agreements on FeMBMS	RAN2, Qualcomm	Patrick Merias	52292	LS in		
R1-1608570	Reply LS on ECID positioning for TDD	RAN2, CATT	Patrick Merias	52292	LS in		
R1-1608571	LS on introduction of new UL categories in Rel-13	RAN2, Qualcomm	Patrick Merias	52292	LS in		
R1-1608572	LS on CSI measurement ambiguity in LAA	RAN4, LGE	Patrick Merias	52292	LS in		
R1-1608573	Response LS on Modelling and simulation of IMT networks for use in sharing and compatibility studies	RAN4, Ericsson	Patrick Merias	52292	LS in		
R1-1608574	LS on Characteristics of terrestrial IMT systems for frequency sharing/interference analysis in the frequency range between 24.25 GHz and 86 GHz	RAN4, Nokia	Patrick Merias	52292	LS in		
R1-1608575	Reply LS on blind detection evaluations	RAN4, MediaTek	Patrick Merias	52292	LS in		
R1-1608576	Reply LS on the feasibility of mobility enhancement solutions	RAN4, Ericsson, ZTE	Patrick Merias	52292	LS in		
R1-1608577	Reply LS on SRS carrier switching interruption time	RAN4, Huawei	Patrick Merias	52292	LS in		
R1-1608578	LS on Measurement gap enhancement	RAN4, Ericsson, Intel	Patrick Merias	52292	LS in		
R1-1608579	LS for definition of SSTD measurement	RAN4, CATT	Patrick Merias	52292	LS in		

R1-1608580	LS on on UCG parameters for eMTC	RAN4, Intel	Patrick Merias	52292	LS in		
R1-1608581	LS on LTE Rel-13 UE feature list	RAN4, Qualcomm, Intel	Patrick Merias	52292	LS in		
R1-1608582	Reply LS on QoS requirements for V2X	SA2, LGE	Patrick Merias	52292	LS in		
R1-1608583	Reply LS on NR requirements	RAN, ZTE	Patrick Merias	52292	LS in		
R1-1608584	Complementary turbo and LDPC codes for NR, motivated by a survey of over 100 ASICs	AccelerComm Ltd	Rob Maunder	67229	discussion		Discussion
R1-1608585	Details on SRS switching-from CC and switching-to CC	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1608586	Other considerations on SRS switching	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608587	Power headroom report for SRS switching	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608588	DCI design for SRS switching	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608589	Details on collision handling for SRS switching	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608590	Details on SRS switching for UEs with multiple antennas	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608591	Resource allocation in partial coverage	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608592	Congestion control for V2V	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608593	Coexistence of cellular and V2V services	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608594	Coexistence of 802.11p and V2V services	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608595	SPS enhancement for V2V mode 1	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608596	SPS enhancement for V2X on Uu interface	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608597	Overview of advanced CSI feedback for LTE	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608598	Interference measurement enhancement in LTE Rel-14	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608599	Uplink channel design for quantized/un-quantized channel representation	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608600	Discussion on non-precoded CSI-RS up to 32 CSI-RS ports	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608601	Enhancement on rate matching for different transmission modes	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608602	On IFDMA based DMRS design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608603	Downlink control signaling design to support IFDMA based DMRS	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1608604	Discussion on power ratios for MUST Case 1&2	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608605	DCI design for MUST Case 1&2	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608606	Discussion on VoLTE coverage enhancement	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608607	Further Discussion on Scheduling and HARQ Timing for PUSCH on UpPTS	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608608	Transmission of PUSCH on UpPTS	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608609	TP for 36.741 on definition and classification of non-coherent JT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608610	Potential enhancements and specification impact analysis of non-coherent JT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608611	Potential enhancements and specification impacts for CS/CB with FD-MIMO	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608612	Discussion on configuration of SC-MTCH in NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608613	Discussion on SC-MTCH transmission in NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608614	Discussion on NPDCCH search space for multicast in NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608615	Discussion on collision handling for multicast in NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1608617	On reusing existing downlink signals for NB-IoT downlink positioning	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608618	Design of new downlink positioning reference signal for NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608619	Configuration of downlink positioning reference signal for NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608620	Evaluation of downlink positioning accuracy for NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608621	Analysis of power consumption and complexity for NB-IoT downlink positioning	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608622	On enabling and disabling of wider bandwidth in FeMTC	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608623	Considerations on the control channel of supporting wider bandwidth in FeMTC	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1608624	DCI design on supporting wider bandwidth in FeMTC	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608625	On supporting larger channel bandwidth for Rel-14 non-BL UEs in CE mode A	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608626	On supporting larger TBS for UEs with maximum 1.4 MHz bandwidth in TDD/HD-FDD	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608627	On supporting larger TBS for UEs with larger bandwidth	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608628	Consideration on SC-PTM transmission for FeMTC	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608629	Analysis on increasing DL HARQ processes in CE mode A for FD-FDD	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608630	HARQ-ACK bundling in HD-FDD	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608631	Discussion on sTTI structure	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608632	Discussion on CRS based sPDCCH	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608633	Discussion on DMRS-based sPDCCH	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608634	Details of two-level DCI schemes for short TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608635	Discussion on DCI design for short TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608636	Discussion on sPDSCH design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608637	Discussion on sPUCCH design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608638	Discussion on sPUSCH design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608639	UCI on sPUSCH	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608640	Handling collision between sTTI and 1ms TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608641	Discussion on UL RS for short TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608642	Discussion on CSI feedback for short TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608643	Processing time reduction and related procedures for short TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608644	Design on shortened processing time for 1ms TTI	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608645	Performance evaluation of short TTI vs. 1ms TTI with processing time reduction	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1608646	TDD-specific design for short TTI	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1608648	On 2 HARQ processes for enhancement of NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608649	Discussion on the P-UE resource selection	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608650	DCI design for sidelink SPS scheduling	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1608652	Discussion on PSBCH contents and SLSS transmission procedure	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608653	Discussion on CA issues for shortened TTI operation	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608654	Processing time reduction and related HARQ timings with 1ms TTI for FS2	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608655	SRS enhancement to supporting higher data rates	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1608660	Unified MIMO framework for NR above and below 6GHz	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
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R1-1608664	High level views on beam management for NR MIMO	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
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R1-1608668	Discussion on interference issues in NR	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
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R1-1608678	MUST system performances with different power ratio choices	ZTE	Yifei Yuan	58525	discussion		
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R1-1608680	Signaling design for MUST	ZTE	Yifei Yuan	58525	discussion		
R1-1608681	Discussion and evaluation for MUST Case 3	ZTE	Yifei Yuan	58525	discussion		
R1-1608682	Discussion on design of linear combination codebook	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608683	Discussion on interference measurement for MU-CSI	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608684	Feedback mechanism for linear combination based CSI	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
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R1-1608688	Further discussion on non-precoded CSI-RS design for eFD-MIMO	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608689	Aperiodic CSI-RS for non-precoded CSI-RS	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608690	Remaining issues on aperiodic CSI-RS	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
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R1-1608692	Potential Enhancement on the Non-coherent JT	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608693	Aperiodic CSI for NR MIMO	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608694	Initial evaluation results of non-coherent JT	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
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R1-1608696	Potential enhancements for CS/CB with FD-MIMO	ZTE, ZTE Microelectronics	Ruyue Yu-Ngok Li	43128	other		
R1-1608697	OTDOA design for NB-IoT	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608698	OTDOA performance for NB-IoT	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608699	A new system simulator for NB-IoT positioning	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608700	On modelling of NPRACH based UTDOA performance	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608701	On NPRACH based UTDOA impact on NB-IOT performance	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608702	On NPRACH based UTDOA capacity	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608703	L1 configuration for multicast support for NB-IoT	Ericsson	Yutao Sui	61418	discussion		Decision

R1-1608704	NB-IoT Paging on non-anchor PRBs	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608705	NB-IoT Paging Capacity	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1608706	CR on 36.211 NB-IoT PDSCH symbol mapping	Ericsson	Yutao Sui	61418	CR		Decision
R1-1608707	CR on 36.213 NB-IoT Type1 and Type 2 search space definition	Ericsson	Yutao Sui	61418	CR		Decision
R1-1608708	Optimized PAPR/CM SC-CPS Waveform and Further Results	Idaho National Laboratory	Ramon Khalona	19055	other		Discussion
R1-1608709	Optimized PAPR/CM SC-CPS Waveform and Further Results	Idaho National Laboratory	Ramon Khalona	19055	other		Discussion
R1-1608710	Frame Structure for Ultra-Low Latency Scheduled-based UL Access	Idaho National Laboratory	Ramon Khalona	19055	other		Discussion
R1-1608711	Common signal/information allocation for initial access and mobility	Mitsubishi Electric Corp	Noriyuki Fukui	23665	discussion		
R1-1608712	RACH preamble transmission	Mitsubishi Electric Corp	Noriyuki Fukui	23665	discussion		
R1-1608713	Correction to DMRS for MPDCCH associated with P-RNTI	Virtuosys Limited	Mark Cannon	64651	draftCR		Discussion
R1-1608714	PSSCH/PSBCH decoding issue	CATT	Yanping Xing	57090	discussion		Decision
R1-1608715	Discussion on randomization on DMRS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608716	Discussion on details of resource reselection	CATT	Yanping Xing	57090	discussion		Decision
R1-1608717	Correction on SSTD definition	CATT	Yanping Xing	57090	CR		Decision
R1-1608718	DCI design to support multiple SPS configurations	CATT	Yanping Xing	57090	discussion		Decision
R1-1608719	Discussion on P-UE resource selection	CATT	Yanping Xing	57090	discussion		Decision
R1-1608720	Measurement metric for the congestion level in V2X	CATT	Yanping Xing	57090	discussion		Decision
R1-1608721	Synchronization enhancements in PC5-based V2V	CATT	Yanping Xing	57090	discussion		Decision
R1-1608722	Multiplexing V2V with other signals/channels	CATT	Yanping Xing	57090	discussion		Decision
R1-1608723	On Prioritization of SL TX for V2X under eNB management	CATT	Yanping Xing	57090	discussion		Decision

R1-1608724	Considerations on advanced CSI reporting	CATT	Yanping Xing	57090	discussion		Decision
R1-1608725	Aperiodic CSI-IM for interference measurement enhancement	CATT	Yanping Xing	57090	discussion		Decision
R1-1608726	Codebook design for advanced CSI reporting	CATT	Yanping Xing	57090	discussion		Decision
R1-1608727	Non-precoded CSI-RS codebook for 20-32 ports	CATT	Yanping Xing	57090	discussion		Decision
R1-1608728	CSI feedback and PDSCH transmission for open-loop MIMO	CATT	Yanping Xing	57090	discussion		Decision
R1-1608729	Consideration on UL DMRS enhancements	CATT	Yanping Xing	57090	discussion		Decision
R1-1608730	Enhanced non-precoded CSI-RS with CDM-8	CATT	Yanping Xing	57090	discussion		Decision
R1-1608731	Enhanced non-precoded CSI-RS with CDM-2/4	CATT	Yanping Xing	57090	discussion		Decision
R1-1608732	Density reduction for class A CSI-RS with 20-32 ports	CATT	Yanping Xing	57090	discussion		Decision
R1-1608733	Remaining issues on aperiodic CSI-RS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608734	PDSCH rate-matching for aperiodic CSI-RS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608735	Density reduction for beamformed CSI-RS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608736	On QCL for aperiodic CSI-RS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608737	On remaining issues on hybrid CSI-RS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608738	Support of downlink superposition transmission	CATT	Yanping Xing	57090	discussion		Decision
R1-1608739	On SRS carrier switching with antenna switching	CATT	Yanping Xing	57090	discussion		Decision
R1-1608740	Remaining issues for PUSCH support in UpPTS	CATT	Yanping Xing	57090	discussion		Decision
R1-1608741	HARQ and scheduling timing design for LTE processing timing reduction with 1ms TTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1608742	On sDCI design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608743	Design of sPDCCH structure	CATT	Yanping Xing	57090	discussion		Decision
R1-1608744	Other issues for sPDCCH design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608745	DL/UL sTTI partition	CATT	Yanping Xing	57090	discussion		Decision

R1-1608746	DMRS design for sPUSCH	CATT	Yanping Xing	57090	discussion		Decision
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R1-1608748	On efficient multiplexing of normal TTI and sTTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1608749	Discussion on UL sTTI operation	CATT	Yanping Xing	57090	discussion		Decision
R1-1608750	sPUCCH design for sTTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1608751	Discussion on the simultaneous transmissions of (s)PUCCH and (s)PUSCH	CATT	Yanping Xing	57090	discussion		Decision
R1-1608752	UCI transmission for LTE sTTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1608753	Implicit HARQ and scheduling timing design for LTE sTTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1608754	Explicit HARQ and scheduling timing design for LTE shorten TTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1608755	LLS results of PDMA with realistic channel estimation	CATT	Yanping Xing	57090	discussion		Decision
R1-1608756	SLS results of PDMA	CATT	Yanping Xing	57090	discussion		Decision
R1-1608757	Consideration on grant-free transmission	CATT	Yanping Xing	57090	discussion		Decision
R1-1608758	Discussion on MA for URLLC	CATT	Yanping Xing	57090	discussion		Decision
R1-1608759	NR numerology	CATT	Yanping Xing	57090	discussion		Decision
R1-1608760	NR CP length for different numerologies	CATT	Yanping Xing	57090	discussion		Decision
R1-1608761	NR symbol alignment and operation in unlicensed spectrum	CATT	Yanping Xing	57090	discussion		Decision
R1-1608762	Way Forward on UE-specific slot configuration	CATT	Yanping Xing	57090	discussion		Decision
R1-1608763	NR Time domain structure: subframe, slot and mini-slot and time interval	CATT	Yanping Xing	57090	discussion		Decision
R1-1608764	NR frame structure for multiplexing of URLLC and eMBB traffic	CATT	Yanping Xing	57090	discussion		Decision
R1-1608765	NR frequency domain structure: PRB	CATT	Yanping Xing	57090	discussion		Decision
R1-1608766	Configurable DL control channel monitoring in NR system design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608767	On-demand access for UE power saving in NR system design	CATT	Yanping Xing	57090	discussion		Decision

R1-1608768	Performance of Turbo codes with high speed decoding algorithm for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608769	Discussion on implementation of high speed Turbo decoder for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608770	Flexibility evaluation of channel coding schemes for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608771	Evaluation of channel coding schemes for NR control channels	CATT	Yanping Xing	57090	discussion		Decision
R1-1608772	LDPC codes design for eMBB	CATT	Yanping Xing	57090	discussion		Decision
R1-1608773	On beam management procedures	CATT	Yanping Xing	57090	discussion		Decision
R1-1608774	Design of beam training	CATT	Yanping Xing	57090	discussion		Decision
R1-1608775	MIMO transmission schemes for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608776	Discussion on UL MIMO for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608777	High-level views on CSI acquisition for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608778	DMRS design for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608779	Consideration on SRS transmission for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608780	Consideration on CSI-RS transmission for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608781	Discussion on phase noise compensation RS for NR	CATT	Yanping Xing	57090	discussion		Decision
R1-1608782	Phase1 calibration for NR MIMO	CATT	Yanping Xing	57090	discussion		Decision
R1-1608783	NR Numerology Agnostic Synchronization Channel Design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608784	NR System Bandwidth Agnostic Synchronization Channel Design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608785	NR Multi-stage Synchronization Channel Design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608786	QCL assumption of NR Synchronization Signals and DM RS of Broadcast Channel	CATT	Yanping Xing	57090	discussion		Decision
R1-1608787	NR RACH Procedure	CATT	Yanping Xing	57090	discussion		Decision
R1-1608788	NR RACH Preamble Design Consideration	CATT	Yanping Xing	57090	discussion		Decision
R1-1608789	NR RRM measurements and mobility management	CATT	Yanping Xing	57090	discussion		Decision

R1-1608790	Interference management for dynamic TDD and flexible duplex	CATT	Yanping Xing	57090	discussion		Decision
R1-1608791	NR DL control channel design considerations	CATT	Yanping Xing	57090	discussion		Decision
R1-1608792	NR UL control channel design considerations	CATT	Yanping Xing	57090	discussion		Decision
R1-1608793	Principle of DL DCI formats design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608794	Principle of UL DCI formats design	CATT	Yanping Xing	57090	discussion		Decision
R1-1608795	NR Scheduling procedure	CATT	Yanping Xing	57090	discussion		Decision
R1-1608796	NR HARQ operation	CATT	Yanping Xing	57090	discussion		Decision
R1-1608797	design of HARQ-ACK bundling for HD-FDD	Sequans Communications	Ron Toledano	49758	discussion		
R1-1608798	on supporting 10 DL HARQ processes	Sequans Communications	Ron Toledano	49758	discussion		
R1-1608799	VoLTE coverage enhancements	Sequans Communications	Ron Toledano	49758	discussion		
R1-1608800	Discussion on real domain OFDM for mMTC	Fujitsu	Tim Moulsley	10954	other		
R1-1608801	Further LLS results for UL non-orthogonal multiple access	Fujitsu	Tim Moulsley	10954	other		
R1-1608802	DM-RS considerations for UL non-orthogonal multiple access	Fujitsu	Tim Moulsley	10954	other		
R1-1608803	Discussion on grant-free transmission for UL multiple access	Fujitsu	Tim Moulsley	10954	other		
R1-1608804	NR Frame structure considerations for low latency TDD operation	Fujitsu	Tim Moulsley	10954	other		
R1-1608805	Discussion on flexible/dynamic TDD	Fujitsu	Tim Moulsley	10954	other		
R1-1608806	Guard period setting in TDD based NR frame structure	Fujitsu	Tim Moulsley	10954	other		
R1-1608807	TDD frame structure with mixed numerology	Fujitsu	Tim Moulsley	10954	other		
R1-1608808	Discussion on subframe design with symbol level alignment	Fujitsu	Tim Moulsley	10954	other		
R1-1608809	Over the air calibration for channel reciprocity in NR MIMO	Fujitsu	Tim Moulsley	10954	other		
R1-1608810	Discussion on Paging in NR	Fujitsu	Tim Moulsley	10954	other		
R1-1608811	Discussion on CSI Acquisition for Massive MIMO in NR	Fujitsu	Tim Moulsley	10954	other		

R1-1608812	Discussion on initial access in NR	Fujitsu	Tim Moulsley	10954	other		
R1-1608813	Discussion on PRACH configuration in NR	Fujitsu	Tim Moulsley	10954	other		
R1-1608814	DL control channel related to multiplexing eMBB and URLLC	Fujitsu	Tim Moulsley	10954	other		
R1-1608815	Scheduling and CQI feedback for URLLC	Fujitsu	Tim Moulsley	10954	other		
R1-1608816	Principles for DL Reference Signal Design and QCL Assumptions	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608817	DL RS design for NR CSI acquisition and beam management	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608818	Reference signal design for demodulation in NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608819	Discussion on DL MIMO transmission	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608820	Discussion on UL MIMO transmission	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608821	UL power control for NR MIMO	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608822	Reference signal design for phase noise compensation in HF	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608823	Unified single/multiple beam-based initial access procedure in NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608824	RACH preamble and procedures for unified single/multiple beam based access	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608825	Low-complexity filter implementation for f-OFDM	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608826	Delay analysis for f-OFDM	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608827	Analysis of guard band for FDM of different numerologies in a NR carrier	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608828	Overview of PAPR reduction techniques	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608829	Uplink coverage performance of OFDM with PAPR reduction for below 6 GHz	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608830	Discussion on TRP-to-TRP interference mitigation schemes	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608831	Discussion on UE-to-UE interference mitigation schemes	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608832	On Support of Aggregation of Carrier on Different Levels	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608833	Discussion on time alignment with different CP overhead	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1608834	Discussion on time alignment with the same CP overhead	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608835	Evaluation on CP types for 60kHz subcarrier	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608836	Discussion on time domain structures	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608837	Discussion on slot and mini-slot	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608838	Discussion on TDD operation on an unpaired spectrum	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608839	Discussion on timing relations for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608840	Discussion on uplink control channel design in NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608841	Support of flexible bandwidth	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608842	Discussion on blank resources	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608843	Overview of URLLC support for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608844	Support of URLLC in DL	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608845	Support of URLLC in UL	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608846	Synchronization signal design in NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608847	Channel raster and synchronization signal locations	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608848	UL based RRM measurement and mobility	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608849	DL based measurement and mobility	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608850	Views on access procedures for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608851	Antenna Structure Impacts on MIMO transmission and codebook design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608852	Categorization and analysis of MA schemes	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608853	Further UL LLS Results	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608854	Further UL SLS Results	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608855	Advanced multi-user detectors for grant-free transmissions	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1608856	Further discussion on URLLC evaluation	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608857	Remaining issues on panel modeling	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608858	Discussion on grant-free versus grant-based transmissions for infrequent small packets	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608859	The retransmission and HARQ schemes for grant-free	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608860	Solutions for collisions of MA signatures	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608861	Resource allocation and management for grant-free UL	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608862	Polar Code Construction for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608863	Evaluation of channel coding schemes for control channel	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608864	Performance Evaluation for NR Channel Coding	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608865	Design aspects of Polar Code/LDPC for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608866	Evaluation of LDPC performance	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608867	Considerations on performance and spectrum efficiency	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608868	Analysis of spectral utilization in a NR carrier	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608869	Grant-free Non-orthogonal MA for uplink URLLC	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608870	Advanced modulation for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1608871	On TBCC Generator Polynomials	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608872	Study of LDPC Codes for Control Channel of NR	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608873	Study of Polar Codes for Control Channel of NR	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608874	Performance Comparison of Channel Coding Candidates for Short Block Lengths	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608875	LDPC Code Design for NR	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608876	LDPC Code Performance with Rate Matching	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608877	On Achieving Low Code Rate with LDPC Codes	Ericsson	Yufei Blankenship	59257	discussion		Decision

R1-1608878	Updated Survey of Channel Coding Implementations	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608879	Implementation Consideration of Channel Coding Options for NR	Ericsson	Yufei Blankenship	59257	discussion		Decision
R1-1608880	UTDOA positioning in NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608881	Existing Downlink Signals for OTDOA Positioning in NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608882	NPRS Design for OTDOA Positioning in NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608883	SC-PTM seach space design for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608884	SC-MCCH transmission for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608885	SC-MTCH transmission for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608886	Random access on non-anchor PRB for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608887	Paging on non-anchor PRB for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608888	Supporting 2 HARQ processes for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608889	Larger maximum TBS for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1608890	Maximum TBS for FeMTC	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608891	Consideration on supporting larger channel bandwidth for FeMTC	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608892	ACK/NACK Bundling in FeMTC	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision

R1-1608893	Increasing the number of HARQ processes in FeMTC	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608894	SPS Design Considerations	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608895	SC-PTM Search Space Considerations	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608896	OTDOA enhancements for FeMTC	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608897	VoLTE performance for Cat-M1 UE	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608898	VoLTE enhancements for FeMTC	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1608899	Details of partial sensing by pedestrian UEs	Sequans Communications	Roy Ron	49992	discussion		Decision
R1-1608900	Subcarrier spacing design for data and reference signal	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608901	Discussion of the UE support of multiple numerologies	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608902	Discussion on subframe structure for NR	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608903	Discussion of the UE processing time on the support of multiple numerologies and frame structures	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608904	Effects of channel reciprocity-based MIMO on frame structure design	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608905	Discussion on Multi-antenna Scheme	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608906	Discussion on multi-beam based synchronization signal and DL broadcast channel for NR	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608907	DL PHY procedure issues for multi-beam based approaches	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608908	On DL HARQ for NR	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608909	UE measurement based congestion control	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		
R1-1608910	Discussion on the GNSS based synchronization	Guangdong OPPO Mobile Telecom.	Yanan Lin	63412	discussion		

R1-1608911	Discussion on resource sensing and selection for pedestrian UEs	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608912	Considerations for shortened processing time	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608913	Discussion on sPDCCH design for sTTI	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608914	Discussion on sPUSCH design for sTTI	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608915	Discussion on DL RS design for sTTI	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608916	Further considerations on waveform configuration	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608917	Considerations on random resource selection	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608918	Multiple access schemes with considering different UE requirements	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608919	Considerations on pre-configured resource for grant-free based UL non-orthogonal MA	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608920	Discussion on numerology of NR	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608921	Code segmentation and CRC issues for LDPC codes	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608922	Performance analysis of channel coding schemes for NR	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608923	Discussion on UL sounding RS design	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608924	Discussion on Synchronization signal design	Spreadtrum Communications	Arto Lehti	61519	discussion		Decision
R1-1608925	Discussion on duplexing modes in NR	Fujitsu	Tim Moulsley	10954	other		
R1-1608926	Codebook Design for Class A CSI Reporting up to 32 Ports	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608927	DMRS-based Semi-open Loop Schemes for Rank 1 Transmission	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608928	Remailing details of UL DMRS Base Sequences with IFDMA	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608929	Control Signaling Design for UL DMRS with IFDMA	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		

R1-1608930	Considerations of Non-precoded CSI-RS for Class A	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608931	Remaining Details of aperiodic CSI-RS and overhead Reduction	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608932	Remaining Details of Hybrid CSI Reporting	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608933	Discussion and Preliminary Simulation Results of NCJT Case 1 of FeCoMP	Nokia, Alcatel-Lucent Shanghai Bell	Min Zhang	47214	other		
R1-1608934	Views on beam management for NR	Sony	Martin Beale	59973	other		
R1-1608935	Evaluation of NU-QAM for NR	Sony	Martin Beale	59973	other		
R1-1608936	Signal Space Diversity Use in NR	Sony	Martin Beale	59973	other		
R1-1608937	Resource Allocation in wide bandwidth feMTC	Sony	Martin Beale	59973	other		
R1-1608938	Considerations on HARQ-ACK Bundling in HD-FDD	Sony	Martin Beale	59973	other		
R1-1608939	Considerations on HARQ Processes in FD-FDD	Sony	Martin Beale	59973	other		
R1-1608940	Multicast Support for feMTC	Sony	Martin Beale	59973	other		
R1-1608941	Multicast Support for eNB-IoT	Sony	Martin Beale	59973	other		
R1-1608942	Multiplexing eMBB and URLLC Transmissions	Sony	Martin Beale	59973	other		
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R1-1608945	Discussion on longer CP lengths	Sony	Martin Beale	59973	other		
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R1-1608947	Discussion on details of partial sensing for pedestrian UEs	Sony	Martin Beale	59973	other		
R1-1608948	Discussion on details of congestion control	Sony	Martin Beale	59973	other		

R1-1608949	CSI feedback for channel reciprocity operation	Sony	Martin Beale	59973	other		
R1-1608950	OTDoA enhancements for feMTC	Sony	Martin Beale	59973	other		
R1-1608951	Sub-carrier spacing considerations for NR DL Synchronization	Sony	Martin Beale	59973	other		
R1-1608952	System level performance evaluation for MUSA	ZTE	Yifei Yuan	58525	discussion		
R1-1608953	Link level performance evaluation for MUSA	ZTE	Yifei Yuan	58525	discussion		
R1-1608954	Physical layer abstraction method for MMSE-SIC type receiver	ZTE	Yifei Yuan	58525	discussion		
R1-1608955	Considerations on the Preamble design for grant-free non-orthogonal MA	ZTE	Yifei Yuan	58525	discussion		
R1-1608956	Summary of [86-18] email discussion on categorization for NR MA schemes	ZTE	Yifei Yuan	58525	discussion		
R1-1608957	Multiplexing of eMBB and URLLC	ZTE	Yifei Yuan	58525	discussion		
R1-1608958	On indicating HARQ timing and PUCCH	ZTE	Yifei Yuan	58525	discussion		
R1-1608959	Fast scheduling and transmission for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608960	Remaning issue on system level evaluation assumptions for URLLC	ZTE	Yifei Yuan	58525	discussion		
R1-1608961	Reference numerology for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608962	About the support of multiple CP families for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608963	About RB grid definition and handling inter-numerology interference in NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608964	About slot structure and scheduling units for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608965	Initial Link Level Simulation Results for URLLC	ZTE	Yifei Yuan	58525	discussion		
R1-1608966	Considerations on sweeping time interval in NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608967	Frequency and Channel Raster Issue in NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608968	Unified Random Access in NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608969	On 2-step Random Access Procedure	ZTE	Yifei Yuan	58525	discussion		
R1-1608970	Idle and connected mode mobility in NR	ZTE	Yifei Yuan	58525	discussion		

R1-1608971	Consideration on the flexibility of LDPC codes for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608972	Consideration on channel coding candidates for NR eMBB	ZTE	Yifei Yuan	58525	discussion		
R1-1608973	Evaluation on channel coding candidates for eMBB control channel	ZTE	Yifei Yuan	58525	discussion		
R1-1608974	Consideration on LDPC design for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608975	Consideration on polar codes for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608976	Consideration on outer codes for NR	ZTE	Yifei Yuan	58525	discussion		
R1-1608977	On the maturity of polar decoders, based on a survey of over 150 hardware implementations	AccelerComm Ltd	Rob Maunder	67229	discussion		Discussion
R1-1608978	Periodic CSI reporting for eLAA	Samsung	Younsun Kim	43499	other		

R1-1608979	Draft CR on Periodic CSI report	Samsung	Younsun Kim	43499	draftCR		Discussion
R1-1608980	Draft CR on start timing of PUSCH	Samsung	Younsun Kim	43499	draftCR		Discussion
R1-1608981	PHR reporting for two-step scheduling	Samsung	Younsun Kim	43499	other		
R1-1608982	CCA slot and tx-rx/rx-tx switching time	Samsung	Younsun Kim	43499	other		
R1-1608983	Further randomization on DMRS and scrambling code	Samsung	Younsun Kim	43499	other		
R1-1608984	On resource (re)selection in 36.213	Samsung	Younsun Kim	43499	other		
R1-1608985	Remaining issues on resource exclusion in Step 2	Samsung	Younsun Kim	43499	other		
R1-1608986	Remaining issues on resource reservation	Samsung	Younsun Kim	43499	other		
R1-1608987	Support of multiple UL SPS configurations	Samsung	Younsun Kim	43499	other		
R1-1608988	Remaining details on DCI design for Mode 3	Samsung	Younsun Kim	43499	other		
R1-1608989	Partial sensing for pedestrian UE	Samsung	Younsun Kim	43499	other		
R1-1608990	Discussion on congestion control	Samsung	Younsun Kim	43499	other		
R1-1608991	Discussion on SLSS based Sidelink synchronization	Samsung	Younsun Kim	43499	other		
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R1-1608993	Coexistence of PC5-based V2V operation and legacy Uu operation	Samsung	Younsun Kim	43499	other		
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R1-1608996	Fall-back mode operation for processing time reduction with 1ms TTI	Samsung	Younsun Kim	43499	other		
R1-1608997	Discussion on processing time reduction with 1ms TTI	Samsung	Younsun Kim	43499	other		

R1-1608998	CSI measurement and reporting for processing time reduction with 1ms TTI	Samsung	Younsun Kim	43499	other		
R1-1608999	TDD DL HARQ-ACK feedback procedure for processing time reduction with 1ms TTI	Samsung	Younsun Kim	43499	other		
R1-1609000	Overview of sTTI operations	Samsung	Younsun Kim	43499	other		
R1-1609001	sDCI for sTTI operation	Samsung	Younsun Kim	43499	other		
R1-1609002	sPDCCH for 2-symbol sTTI	Samsung	Younsun Kim	43499	other		
R1-1609003	sPDCCH for 1-slot sTTI	Samsung	Younsun Kim	43499	other		
R1-1609004	sPDSCH for 2-symbol/1-slot sTTI	Samsung	Younsun Kim	43499	other		
R1-1609005	sPUCCH for 2-symbol, 4-symbol, 1-slot sTTI	Samsung	Younsun Kim	43499	other		
R1-1609006	sPUSCH for 2-symbol, 4-symbol, 1-slot sTTI	Samsung	Younsun Kim	43499	other		
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R1-1609008	Coexistence between 1ms TTI and sTTI operations for DL/UL	Samsung	Younsun Kim	43499	other		
R1-1609009	Processing time reduction for sTTI operation	Samsung	Younsun Kim	43499	other		
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R1-1609017	Discussions on enhanced interference measurement based on aperiodic IMR	Samsung	Younsun Kim	43499	other		

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R1-1609024	Discussions on CDM-4/-8 for non-precoded CSI-RS	Samsung	Younsun Kim	43499	other		
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R1-1609170	Correction on CSI measurement in LAA	LG Electronics	Youngwoo Yun	45048	draftCR		Discussion
R1-1609171	Correction on NZP CSI-RS aggregation for Class A	LG Electronics, Samsung	Youngwoo Yun	45048	draftCR		Discussion
R1-1609172	Discussion on (E)PDCCH candidate configuration	LG Electronics	Youngwoo Yun	45048	discussion		Decision
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R1-1609231	Discussion on 60kHz CP options	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609232	Details on symbol-level alignment	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609233	Discussion on time-alignment between different CP families	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609234	Discussion on frequency-alignment and resource block structure for different numerologies	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609235	Discussion on subframe/slot/mini-slot	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609236	On multiplexing between eMBB and URLLC	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609237	Discussion on control and data transmssion of URLLC	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609238	Discussion on multi-carrier operation between LTE and NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609239	HARQ of LDPC code for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609240	Comparison of complexity for turbo and LDPC codes	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609241	Consideration on implementation of flexible channel decoder	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609242	Length flexibility of QC-LDPC	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609243	Channel coding selection of eMBB scenario	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609244	Control channel coding scheme evaluation	LG Electronics	Youngwoo Yun	45048	discussion		Decision

R1-1609245	Multiple CRC for TBCC list decoding	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609246	Turbo code enhancement	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609247	Views on NR beam management	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609248	On the impact of UE rotation	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609249	Views on NR DL MIMO	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609250	Views on NR UL MIMO	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609251	Discussion on semi-OL MIMO for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609252	Discussion on interference management for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609253	Views on CSI acquisition for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609254	Discussion on interference measurement for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609255	Discussion on channel reciprocity for NR MIMO	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609256	Discussion on beam coordination and QCL for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609257	Design considerations on NR CSI-RS	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609258	Discussion on UL sounding signal design for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609259	Issues on NR DMRS Design	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609260	Discussion on NR DMRS Pattern	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609261	Discussion on Common Phase Error Compensation for Above 6GHz	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609262	Phase 1 system level calibration results for NR MIMO	LG Electronics	Youngwoo Yun	45048	discussion		Information
R1-1609263	Phase 1 link level calibration results for NR MIMO	LG Electronics	Youngwoo Yun	45048	discussion		Information
R1-1609264	Issues on NR Initial Access	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609265	Numerology for NR Synchronization Signal	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609266	Discussion on PRACH Preamble Design for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision

R1-1609267	Consideration on RACH Procedure in NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609268	Measurement for Mobility and Beam Procedure in NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609269	Discussion on flexible duplex operations in NR design	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609270	Semi-static DL/UL configuration for inter-cell interference coordination/handling	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609271	Interference coordination for flexible duplex operation	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609272	Remaining issues on evaluation assumptions for flexible duplex	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609273	Overall structure of DL control transmission for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609274	Discussion on DL control channel design for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609275	Discussion on common control signaling for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609276	Structure of control and data multiplexing for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609277	Discussion on UL control channel design for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609278	Discussion on support of CA operation in NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609279	Discussion on UL power control procedure for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609280	Discussion on HARQ timing and resource for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609281	Discussion on scheduling in time domain for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609282	Discussion on HARQ latency reduction for NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609283	Discussion on potential HARQ operation in NR	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609284	Discussion on minimum HARQ-ACK and retransmission timing	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609285	Forward compatibility issues considering NR operation in unlicensed spectrum	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609286	On coexistence of NR and LTE	LG Electronics	Youngwoo Yun	45048	discussion		Decision
R1-1609287	Forward compatibility issues on mMTC	LG Electronics	Youngwoo Yun	45048	discussion		Decision

R1-1609288	MIMO LLS calibration results for NR on 30GHz frequency band	Samsung Electronics Co., Ltd	Younsun Kim	43499	other		
R1-1609289	Considerations on multiple anchor PRBs for NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1609290	Discussion on SL-SPS DCI and cross carrier scheduling	CMCC	Hui Tong	58245	other		
R1-1609291	Enhancing interference measurement for MU transmissions	CMCC	Hui Tong	58245	other		
R1-1609292	Views on MUST power ratio signaling	CMCC	Hui Tong	58245	other		
R1-1609293	On signaling design for MUST case 3	CMCC	Hui Tong	58245	other		
R1-1609294	Discussion on DMRS design for PUSCH in UpPTS	CMCC	Hui Tong	58245	other		
R1-1609295	Discussion on TBS scaling design for PUSCH in UpPTS	CMCC	Hui Tong	58245	other		
R1-1609296	Discussion on TTI bundling for PUSCH in UpPTS	CMCC	Hui Tong	58245	other		
R1-1609297	Discussion on HARQ timing design for PUSCH in UpPTS	CMCC	Hui Tong	58245	other		
R1-1609298	Discussion on HARQ timing for shortened TTI in TDD	CMCC	Hui Tong	58245	other		
R1-1609299	Discussion and evaluation of UL Waveforms	CMCC	Hui Tong	58245	other		
R1-1609300	Discussion on multiple access schemes for URLLC	CMCC	Hui Tong	58245	other		
R1-1609301	Discussion on phase noise modeling	CMCC	Hui Tong	58245	other		
R1-1609302	Discussion on High Mobility Numerology and RS design	CMCC	Hui Tong	58245	other		
R1-1609303	Discussion and evaluation of CP design for NR	CMCC	Hui Tong	58245	other		
R1-1609304	Discussion on guard period in NR frame structure	CMCC	Hui Tong	58245	other		
R1-1609305	Updated System Level Evaluation for NR MIMO	CMCC	Hui Tong	58245	other		
R1-1609306	General Requirements on NR MIMO	CMCC	Hui Tong	58245	other		
R1-1609307	Considerations on DL CSI acquisition framework of massive MIMO for new radio	CMCC	Hui Tong	58245	other		
R1-1609308	Beam Sweeping using Multi-width Beams	CMCC	Hui Tong	58245	other		

R1-1609309	RACH in Gradual UE-Specific (GUS) initial access	CMCC	Hui Tong	58245	other		
R1-1609310	On multi-beam-based mobility management	CMCC	Hui Tong	58245	other		
R1-1609311	Discussion on uplink control channel design for NR	CMCC	Hui Tong	58245	other		
R1-1609312	Remaining evaluation details of High Speed Train Scenario	CMCC	Hui Tong	58245	other		
R1-1609313	Numerologies for different carrier frequencies	KT Corp.	Hyojin Lee	61721	discussion		
R1-1609314	Initial timing and beam acquisition for multi-beam based approach	KT Corp.	Hyojin Lee	61721	discussion		
R1-1609315	On maximum TA and EPDCCH support for n+3 timing	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Approval
R1-1609316	On support of n+2 timing for 1ms TTI	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Approval
R1-1609317	Dynamic fall-back and required scheduling restrictions for 1ms TTI with different processing times	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Approval
R1-1609318	On DCI details for 1ms TTI UL asynchronous HARQ	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Approval
R1-1609319	Interaction between synchronous and asynchronous UL HARQ for 1ms TTI	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Approval
R1-1609320	On processing time reduction between PDSCH transmission and DL HARQ feedback	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Discussion
R1-1609321	On processing time reduction between UL grant and UL data transmission	Nokia, Alcatel-Lucent Shanghai Bell	Klaus Hugl	35443	other		Discussion
R1-1609322	On DL control channel design for shorter TTI operation	Nokia, Alcatel-Lucent Shanghai Bell	Karol Schober	64460	other		Approval
R1-1609323	On two-level DL control channel design and subframe structure for shorter TTI operation	Nokia, Alcatel-Lucent Shanghai Bell	Karol Schober	64460	other		Approval
R1-1609324	On design of search space for short PDCCH	Nokia, Alcatel-Lucent Shanghai Bell	Karol Schober	64460	other		Approval

R1-1609325	On details of flexible DMRS design for DL shorter TTI	Nokia, Alcatel-Lucent Shanghai Bell	Karol Schober	64460	other		Approval
R1-1609326	Unified Framework for Beam Management and RRM for NR	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609327	CSI framework for multi-beam operation	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609328	Definition of a Downlink Basic Beacon Unit in the Unified Framework for NR Initial Access	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609329	Synchronization Signal Design in CP-OFDM Based on Time-Frequency Hopping Patterns	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609330	Link level simulation results for NR initial synchronization and cell search	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609331	System level simulation results for NR initial synchronization and cell search	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609332	LLS results for GOCA schemes	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609333	LLS results for RDMA schemes	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609334	System level evaluation result on RDMA	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609335	System level evaluation result on GOCA	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609336	UE considerations on coding combination for NR data channels	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609337	Implementation considerations on flexible and efficient LDPC decoders	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609338	Resolving Polar code memory complexity issue	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609339	Some issues in 1ms TTI with shortened processing time	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609340	HARQ with shortened processing time for 1ms TTI	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609341	Discussion on sPDCCH for sTTI	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609342	Discussion on PUCCH design for sTTI	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609343	Study on PDSCH transmission in sTTI	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609344	Details on timing advance for SRS on TDD CCs without PUSCH	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609345	MUST UE multiplexing and resource allocation	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1609346	Inter-PLMN operation on PC5	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609347	Timing alignment for cross-carrier operation	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609348	Considerations on increased number of MBSFN subframes	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609349	Restricted sets of cyclic shifts for PRACH in high speed scenario	Huawei	Brian Classon	45750	other		
R1-1609350	On the support for legacy UEs in high speed cells	Huawei	Brian Classon	45750	other		
R1-1609351	Further discussion on the same PCI case for E-CID enhancements	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609352	Further discussion on the UE Rx-Tx measurement over multiple serving cells	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609353	Discussion on Gray conversion for MUST Case 1&2	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609354	Discussion on UCI in PUSCH on UpPTS	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609355	Simulation results of non-coherent JT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609356	Simulation results of CS/CB with FD-MIMO	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609357	On non-anchor carrier paging	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609358	Control channel design on supporting SC-PTM in FeMTC	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609359	Discussion on the OTDOA enhancements for FeMTC	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609360	Discussion on sensing procedure for PC5 based V2V	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609361	Discussion on UE capability in decoding PSSCH and PSCCH	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609362	Discussion on sensing window range for PC5 based V2V	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609363	Discussion on resource pool for PC5 based V2V	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1609364	Coexistence of cellular and V2V services in partial network coverage	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609365	Details for supporting traffic with smaller periodicity on PC5 based V2V	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609366	Draft CR on UL CWS adjustment for eLAA in 36.213	Huawei, HiSilicon	Brian Classon	45750	draftCR		Discussion
R1-1609367	Draft CR on PHICH operation for eLAA in 36.213	Huawei, HiSilicon	Brian Classon	45750	draftCR		Discussion
R1-1609368	Draft CR on energy detection threshold for DL multi-carrier operation for LAA in 36.213	Huawei, HiSilicon	Brian Classon	45750	draftCR		Discussion
R1-1609369	On half duplex enhancements for VoLTE	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609370	Evaluations of feMTC OTDOA	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609371	On larger TBS for enhancement of NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609372	DCI formats for enhancement of NB-IoT	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609373	Discussion on the remaining issues for sidelink power control	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609374	Study on PUSCH transmission in sTTI	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609375	Simultaneous transmission and reception in sTTI	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609376	Processing time reduction and related procedures	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609377	RSTD measurement and reporting in NB-IoT	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	discussion		
R1-1609378	A New DFTS-OFDM Compatible Low PAPR Technique for NR Uplink Waveforms	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609379	Discussion on Beam Training Procedure of NR MIMO	Sony	Martin Beale	59973	other		
R1-1609380	Massive MIMO: Channel State Information (CSI) Acquisition in Angular Domain	Sony	Martin Beale	59973	other		
R1-1609381	Discussion on DCI options for providing MUST-near UE co-schedule information	Sony	Martin Beale	59973	other		

R1-1609382	Evaluation on channel coding candidates for uRLLC and mMTC	ZTE	Yifei Yuan	58525	discussion		
R1-1609383	Summary of Link level analysis of candidate waveforms for NR	AT&T GNS Belgium SPRL	Sharat Chander	14851	discussion		Decision
R1-1609384	Network Assisted Waveform Selection for NR	AT&T GNS Belgium SPRL	Sharat Chander	14851	discussion		Decision
R1-1609385	Link level analysis for channel coding schemes for control channel	AT&T GNS Belgium SPRL	Sharat Chander	14851	discussion		Decision
R1-1609386	NR Frame Structure Design Requirements	AT&T GNS Belgium SPRL	Sharat Chander	14851	discussion		Decision

R1-1609387	Initial Access and Mobility Requirements for NR	AT&T GNS Belgium SPRL	Sharat Chander	14851	discussion		Decision
R1-1609388	Generalized CSI feedback framework for NR MIMO	AT&T GNS Belgium SPRL	Sharat Chander	14851	discussion		Decision
R1-1609389	On the channel coding scheme for NR	NEC	Rajitha Palipana	57803	discussion		Decision
R1-1609390	Low PAPR Waveform Design for NR	IITH	Kuchi Kiran	61192	discussion		Decision
R1-1609391	Frequency domain NR frame structure	ETRI	Jihyung Kim	65152	discussion		
R1-1609392	Multiplexing of eMBB and URLLC transmissions	ETRI	Jihyung Kim	65152	discussion		

R1-1609393	Discussion on the slot structure in time domain	ETRI	Jihyung Kim	65152	discussion		
R1-1609394	Design of synchronization signal for supporting different numerologies in NR	ETRI	Jihyung Kim	65152	discussion		
R1-1609395	Discussion of DL hybrid beamforming procedure	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609396	Discussion RACH procedure in beamformed scenarios	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609397	Discussion on Higher Data Rate for Further eMTC	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609398	Uplink Grant-free Access for 5G mMTC	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609399	Discussion on grant-free based UL transmission	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609400	Discussion on retransmission design for grant-free based UL transmission	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609401	Discussion on DCI design to support multiple SPS configurations	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609402	Discussion on random selection by pedestrian UEs	Lenovo	Chenxi Zhu	64707	discussion		Discussion
R1-1609403	Correction on the determination of NPDCCH candidates	ITRI	Chia-pang Yen	44989	CR		Decision
R1-1609404	Correction on the determination of NPDCCH candidates	ITRI	Chia-pang Yen	44989	CR		Decision
R1-1609405	On the carrier aggregation system supporting shortened TTI operation	ITRI	Chia-pang Yen	44989	discussion		
R1-1609406	Discussion on the power headroom reporting for shortened TTI operation	ITRI	Chia-pang Yen	44989	discussion		
R1-1609407	Discussion on frequency domain reduced overhead CSI-RS	ITRI	Chia-pang Yen	44989	discussion		
R1-1609408	Discussion on beam management procedure	ITRI	Chia-pang Yen	44989	discussion		
R1-1609409	Coordinated and uncoordinated operation in inter-PLMN for V2X scenario	ITRI	Chia-pang Yen	44989	discussion		
R1-1609410	Discussion prioritization of multiple synchronization sources on sidelink synchronization protocol for V2V communication	ITRI	Chia-pang Yen	44989	discussion		
R1-1609411	Enhancement to sidelink synchronization among multiple synchronization sources for V2X communications	ITRI	Chia-pang Yen	44989	discussion		
R1-1609412	Discussion measurement metric and report for zone based resource management in V2V service	ITRI	Chia-pang Yen	44989	discussion		

R1-1609413	Reference Signal design for UL based measurement, CSI acquisition, and beam management	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609414	Discussion on beam management aspects for DL MIMO	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1609416	Discussion on CSI measurement and reporting	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609417	Overview of coordination schemes and interference management techniques in NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609418	DL RS design for downlink-based RRM measurement and TRP/beam discovery	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609419	In-band Tx requirements for FDM of different numerologies in a NR carrier	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1609421	General discussion on flexible duplex	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609422	Evaluation of flexible duplex in indoor hotspot scenario	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609423	Evaluation of flexible duplex in dense urban scenario	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609424	Evaluation of flexible duplex in urban macro scenario	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609425	Discussion on UE behavior on mixed numerology carrier	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609426	Evaluation on subcarrier spacing and CP types for UL transmission	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609427	Evaluation and discussion on CP types for above 6GHz	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609428	Numerology for 70 GHz and above	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609429	Discussion on resource block for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609430	On multiple carrier operation	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1609432	Discussion on downlink control channel design	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1609434	Discussion on UE power consumption reduction in NR	Huawei, HiSilicon	Brian Classon	45750	other		
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R1-1609436	Support of multiple numerologies in synchronization signal design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609437	Scenarios and initial evaluation for UL-based RRM measurement and mobility	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609438	Initial evaluation results for initial access	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609439	Further results on channel coding schemes for NR	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609440	Analysis on orthogonal/non-orthogonal basis for advanced CSI feedback	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609441	Text Proposal of PHY abstraction method for NR MA	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609442	Summary of email discussion thread 86-15 and 86-17 on SLS calibration for NR MA	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609443	Summary of preliminary LLS results	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609444	Summary of preliminary SLS results	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609445	Discussion on MIMO calibration	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609446	Reference signal design for UL grant-free transmission	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609447	Way Forward on Modeling Line-of-Sight Blockage for V2V	Huawei, HiSilicon, Volkswagen, Ericsson, General Motors, Vodafone	Brian Classon	45750	other		
R1-1609448	Low frequency assisted high frequency operation on initial access	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609449	Correction on periodic CSI reporting mode 2-1 for Class B FD-MIMO	Intel Corporation, ZTE, ZTE Microelectronics	Seunghee Han	47329	draftCR		Discussion
R1-1609450	Correction on periodic CSI reporting mode 1-1 for Class B FD-MIMO	Intel Corporation, ZTE, ZTE Microelectronics	Seunghee Han	47329	draftCR		Discussion
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R1-1609454	Clarification on Resource Selection Procedure (Correction to V2V CR - 36.213)	Intel Corporation	Seunghee Han	47329	discussion		Decision
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R1-1609668	NR Synchronization signals for idle and connected mode mobility	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609669	Overview of synchronization signal design for NR initial access	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609670	NR random access procedure	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609671	NR PRACH preamble design	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609672	NR PRACH preamble evaluations	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609673	NR random-access response design	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609674	NR random-access response signal format	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609675	NR DL mobility measurement signal design	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1609676	MBSFN reference signal design	Ericsson	Joerg Huschke	12018	discussion		Decision

R1-1609677	Synchronization and acquisition of system information for FeMBMS carrier	Ericsson	Joerg Huschke	12018	discussion		Decision
R1-1609678	CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	Ericsson	Joerg Huschke	12018	discussion		Decision
R1-1609679	Clarifications about NPRACH configuration parameters	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	CR		Decision
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R1-1609688	PUSCH in SRS carrier switching	Ericsson	Florent Munier	46491	discussion		Discussion
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R1-1609709	Radio measurements for congestion control for V2X	Ericsson	Stefano Sorrentino	44504	discussion		
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R1-1609738	RACH resource configuration for single-beam and multi-beam operation	Nokia, Alcatel-Lucent Shanghai Bell	Sigen Ye	45768	discussion		
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R1-1609754	Beam management principles	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1609755	On codewords and layer mapping	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1609756	On NR MIMO below 6 GHz	Ericsson	Mattias Frenne	33019	discussion		Decision
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R1-1609758	Overview of CSI framework for NR	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1609759	On CSI reporting methods in NR	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1609760	Decoupled CSI framework for NR	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1609761	Details on the unified CSI framework for NR	Ericsson	Mattias Frenne	33019	discussion		Decision
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R1-1609764	On UL RS for CSI measurements	Ericsson	Mattias Frenne	33019	discussion		Decision
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R1-1609769	DMRS density configurations in the time domain	Ericsson	Mattias Frenne	33019	discussion		Decision
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R1-1609772	Concatenated block RS design	Ericsson	Mattias Frenne	33019	discussion		Decision
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R1-1609777	Draft CR on eLAA UL Multicarrier channel access	BROADCOM LIMITED	Sindhu Verma	57333	draftCR		Discussion
R1-1609778	Further discussions on FB-OFDM	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
R1-1609779	Further evaluations on FB-OFDM	ZTE, ZTE Microelectronics	Wenfeng Zhang	36150	other		
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R1-1609785	e-mail discussion summary [86-28] on additional feature calibration	Samsung	Young Han Nam	59142	other		Discussion
R1-1609786	Comments on Pool Configuration with Random Resource Selection	Nokia, Alcatel-Lucent Shanghai Bell	Torsten Wildschek	68154	other		Decision

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R1-1609788	On congestion control for PC5-based V2X	Nokia, Alcatel-Lucent Shanghai Bell	Torsten Wildschek	68154	other		Decision
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R1-1609791	Proposals for frame format supporting different CP families	Mitsubishi Electric	Cristina Ciochina-Duchesne	56339	discussion		Decision
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R1-1609793	TR25.996_CR_Equation_Numbering	Fraunhofer HHI	Leszek Raschkowski	57944	CR		Decision
R1-1609794	TR36.814_CR_Equation_Numbering	Fraunhofer HHI	Leszek Raschkowski	57944	CR		Decision
R1-1609795	TR36.873_CR_Equation_Numbering	Fraunhofer HHI	Leszek Raschkowski	57944	CR		Decision
R1-1609796	TR38.900_CR_Section_7.5	Fraunhofer HHI	Leszek Raschkowski	57944	CR		Decision
R1-1609797	TR38.900_CR_Section_7.6.2.2	Fraunhofer HHI	Leszek Raschkowski	57944	CR		Decision
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R1-1609801	Discussion on grant-free transmission based on sensing	ZTE	Carolyn Taylor	19440	discussion		
R1-1609802	Operation on high frequency band of unlicensed spectrum in NR	ZTE	Carolyn Taylor	19440	discussion		
R1-1609803	Discussion on NR operation in unlicensed spectrum	ZTE	Carolyn Taylor	19440	discussion		
R1-1609804	Scheduling of V2X SPS resources	ZTE	Carolyn Taylor	19440	discussion		

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R1-1609807	Co-channel coexistence between DSRC and LTE V2V on same channel	ZTE	Carolyn Taylor	19440	discussion		
R1-1609808	Discussion on congestion control of PC5 carrier	ZTE	Carolyn Taylor	19440	discussion		
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R1-1609810	Discussion on smaller periodicity	ZTE	Carolyn Taylor	19440	discussion		
R1-1609811	TP on PSBCH	ZTE	Carolyn Taylor	19440	discussion		

R1-1609812	Discussion on PSD offset with PSCCH and PSSCH	ZTE	Carolyn Taylor	19440	discussion		
R1-1609813	Uplink waveform evaluations and proposals for NR Phase 1	Panasonic Corporation	Tetsuya Yamamoto	59095	discussion		
R1-1609814	Multiple access schemes for NR phase 1	Panasonic Corporation	Tetsuya Yamamoto	59095	discussion		
R1-1609815	Discussion on frequency domain frame structure for NR	Panasonic Corporation	Tetsuya Yamamoto	59095	discussion		
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R1-1609818	NR PSS Design for Wideband and Narrowband UEs	Sierra Wireless, S.A.	Gustav Vos	31476	discussion		Discussion
R1-1609819	Ack Bundling Design Considerations	Sierra Wireless, S.A.	Gustav Vos	31476	discussion		Discussion
R1-1609820	Considerations on short TTI design	Mediatek Inc.	Weidong Yang	61100	other		
R1-1609821	Considerations on processing time reduction for legacy TTIs	Mediatek Inc.	Weidong Yang	61100	other		
R1-1609822	UL RS design for short TTI	Mediatek Inc.	Weidong Yang	61100	other		
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R1-1609826	Clarification of number of repetitions of PUCCH	ZTE	Shupeng Li	58860	draftCR		Discussion
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R1-1609828	Discussion on support of larger PDSCH/PUSCH bandwidth for MTC	ZTE	Shupeng Li	58860	discussion		Discussion
R1-1609829	Resource allocation for larger PDSCH/PUSCH bandwidth for MTC	ZTE	Shupeng Li	58860	discussion		Discussion
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R1-1609858	Feedback Mechanisms for Advanced CSI	Ericsson	Mark Harrison	59252	other		
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R1-1609868	Further discussion on change notification of SC-PTM for NB-IoT	Sharp	Toshizo Nogami	60264	other		
R1-1609869	Shortened processing time operation for 1ms TTI	Sharp	Toshizo Nogami	60264	other		
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R1-1609874	Supporting URLLC in NR: Views and Recommendations	Sharp	Toshizo Nogami	60264	other		
R1-1609875	Numerology for DL synchronization in NR	Sharp	Toshizo Nogami	60264	other		
R1-1609876	Numerology for PRACH preamble in NR	Sharp	Toshizo Nogami	60264	other		
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R1-1609880	Discussion on the DL control channel design	Shenzhen Coolpad Technologies	Yajun Zhu	59342	other		Discussion
R1-1609881	Discussion on the DL control channel design	Shenzhen Coolpad Technologies	Yajun Zhu	59342	other		Discussion
R1-1609882	Joint group DCI for SRS switching	Nokia, Alcatel-Lucent Shanghai Bell	Chunhai Yao	25041	discussion		Discussion
R1-1609883	HARQ timing for PUSCH transmission in special subframe	Nokia, Alcatel-Lucent Shanghai Bell	Chunhai Yao	25041	discussion		Discussion
R1-1609884	HARQ timing for TTI bundling for PUSCH transmission in special subframe	Nokia, Alcatel-Lucent Shanghai Bell	Chunhai Yao	25041	discussion		Discussion
R1-1609885	Non-precoded CSI-RS design for eFD-MIMO	Potevio	Zhi Lu	60015	discussion		
R1-1609886	Discussion on flexible slot structure with different numerologies	Potevio	Zhi Lu	60015	discussion		
R1-1609887	Coexistence of CP OFDM and CP DFT-s-OFDM for NR UL	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609888	Details of multiple SPS configurations for V2X over Uu	Potevio	Zhi Lu	60015	discussion		
R1-1609889	Waveform design considerations for carrier frequencies above 40 GHz	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		

R1-1609890	Requirements on Future Railway Mobile Communcation	ZTE, China Academy of Railway Sciences (CARS), CATR	Carolyn Taylor	19440	discussion		
R1-1609891	Interleaved-based MA in Fading and Asynchronous environments	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609892	On the Performance of Interleaved-based Multiple Access Schemes	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609893	Considerations on UL grant-free transmissions for mMTC	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609894	System level evaluations for multiple CP lengths	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
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R1-1609896	Performance Evaluation of Channel Codes for eMBB Control Channel	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609897	Updated LDPC Simulation Data Sharing	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609898	Performance Evaluation of Puncturing Schemes for Polar Codes	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609899	Interleaver for Polar Codes	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609900	Performance Evaluation of Dual Carrier Modulation for New Radio	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609901	Evaluation of Spatial Modulation with Spatial Correlation and Imperfect Channel Estimation	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609902	On Fractional N-ary Modulation for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609903	Partial reciprocity based UL MIMO schemes	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609904	Impact of UE Calibration in a Reciprocity-based UL MIMO Transmission	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		

R1-1609905	MIMO transmission schemes for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609906	CSI acquisition for NR MIMO	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609907	Consideration of Short Block-length for CQI Feedback for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609908	Considerations on DCI design for shortened TTI	Beijing Xiaomi Mobile Software	Yang Liu	66714	discussion		Decision
R1-1609909	Considerations on demodulation RS design for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609910	Considerations on measurement RS design for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609911	On the need of phase noise correction reference signal	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609912	Unified Control Channel Design for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609913	On Non-orthogonal Control Channel Design for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609914	Shortened TTI design	Motorola Mobility	Ravikiran Nory	36375	other		
R1-1609915	Multiplexing of Regular TTI and shortened TTI	Motorola Mobility	Ravikiran Nory	36375	other		
R1-1609916	CSI aspects of shortened TTI operation	Motorola Mobility	Ravikiran Nory	36375	other		
R1-1609917	Synchronisation signal in NR	Motorola Mobility	Ravikiran Nory	36375	other		
R1-1609918	Random access in NR	Motorola Mobility	Ravikiran Nory	36375	other		
R1-1609919	Flexible frame structure and control signalling for NR	Motorola Mobility	Ravikiran Nory	36375	other		
R1-1609920	Considerations for Initial Synchronization in NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1609921	Design and performance evaluation for advanced CSI feedback	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609922	Advanced CSI feedback for Class B	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609923	Support of multi-shot CSI-RS	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609924	Support of aperiodic CSI-RS	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609925	Discussion on DMRS sequence design	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609926	Codebook design for up to 32 CSI-RS ports	Huawei, HiSilicon	Brian Classon	45750	other		

R1-1609927	Discussion on Hybrid CSI reporting	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609928	DMRS based semi-open loop transmission	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609929	Introduction of PRACH enhancement for high speed scenario	Huawei	Brian Classon	45750	other		
R1-1609930	Discussion on power allocation issue for MUST Case 1&2	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609931	Simulation results for MUST Case 3	Huawei, HiSilicon	Brian Classon	45750	other		
R1-1609932	SC-PTM Enhancements for V2X	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609933	On suitability of Uu transport and PC5 transport for V2X Solutions	MediaTek Inc.	Tao Chen	56050	discussion		
R1-1609934	Draft LS response to 802.11 regarding LAA	Qualcomm Incorporated	Peter Gaal	57198	LS out		Decision
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R1-1609937	Discussion on periodic and aperiodic CSI reporting in LAA	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
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R1-1609945	Draft 212 CR on UL resource allocation for 10MHz eLAA	Qualcomm Incorporated	Peter Gaal	57198	draftCR		Discussion
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R1-1609947	Discussion on trigger monitoring timeline for two stage triggered grants in eLAA	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
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R1-1610052	Workplan for Study on NR Access Technology	NTT DOCOMO, INC.	Kazuaki Takeda	59634	Work Plan		
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R1-1610054	Views on UL waveform for NR	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		

R1-1610055	Wider BW operation for NR	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		
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R1-1610081	Time-domain aspects of frame structure	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		
R1-1610082	Multiplexing mechanism for eMBB and URLLC	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		
R1-1610083	Initial views on UL control channel design	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		
R1-1610084	HARQ and scheduling operation for NR	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		
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R1-1610087	Initial evaluation results of dynamic TDD	NTT DOCOMO, INC.	Kazuaki Takeda	59634	discussion		
R1-1610088	On time alignment between numerologies of different CP overhead	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610089	DL control channel framework for NR	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610090	Scheduling and support of service multiplexing	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610091	In-band full duplexing in NR	HTC Corporation	Ling-san Meng	59466	discussion		Discussion
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R1-1610095	Discussion on DL multi-antenna transmission schemes	CHTTL	Chih Hsuan Chen	57648	other		
R1-1610096	On sPDCCH Design	InterDigital Communications	Moon-il Lee	46436	discussion		

R1-1610097	On sPDSCH Design	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610098	On sPUCCH Design	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610099	On sPUSCH Design	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610100	Processing Time Reduction for sTTI	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610101	Performance evaluation of explicit CSI feedback	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610102	CSI-RS overhead reduction	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610103	Initial NR MIMO Calibration Results	Beijing Xinwei Telecom Techn.	Peng Sun	62183	discussion		
R1-1610104	A-CSI-RS Impacts on EPDCCH	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610105	PDSCH rate-matching for A-CSI-RS	InterDigital Communications	Moon-il Lee	46436	discussion		
R1-1610106	Discussion on power allocation for SC-PTM	TD Tech, Huawei	Ying Chen	34959	discussion		Decision
R1-1610107	Precoder flexibility and forward compatibility of CPS-OFDM waveform	National Taiwan University	Yenming Huang	65811	discussion		
R1-1610108	Evaluation results of CPS-OFDM waveform	National Taiwan University	Yenming Huang	65811	discussion		
R1-1610109	NR and LTE coexistence assisted by embedded-GFDM	National Taiwan University	Yenming Huang	65811	discussion		
R1-1610110	Correction on downlink power allocation for SC-PTM	TD Tech, Huawei	Ying Chen	34959	CR		Decision
R1-1610111	Phase I Waveform proposal: CP-OFDM plus DFT-s-OFDM	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610112	On the impact of beamforming to link budget comparison of DFTs-OFDM and OFDM	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610113	Coverage analysis of DFT-s-OFDM and OFDM with low PAPR techniques	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610114	User Multiplexing of DFTs-OFDM and OFDM in uplink	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610115	UL reference signal design for eMBB with CP-OFDM and DFT-s-OFDM	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610116	UL waveform considerations for mmW	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
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R1-1610118	Link level simulation results for RSMA vs OMA	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion

R1-1610119	System level simulation results for calibration	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
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R1-1610121	Battery life analysis for grant-free transmission	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610122	Mixed grant-free and grant based multiple access	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610123	URLLC numerology and frame structure design	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
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R1-1610129	Summary of [86-19] Discussion on Slot Structure Use Cases	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
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R1-1610193	Considerations on power scaling rules for 2ms+10ms configurations	Huawei, HiSilicon	Carmela Cozzo	55181	other		
R1-1610194	HS-SCCH order design for TTI switching	Huawei, HiSilicon	Carmela Cozzo	55181	other		
R1-1610195	Response to RAN2 LS on MC enhancements	Huawei, HiSilicon	Carmela Cozzo	55181	other		
R1-1610196	Configuration of physical layer parameters for MC enhancements	Huawei, HiSilicon	Carmela Cozzo	55181	other		
R1-1610197	Correction on CWp adjustment on Type B1 multi-carrier access procedure for Rel-13 LAA	WILUS Inc.	Minseok Noh	62848	draftCR		Discussion
R1-1610198	Correction on PUSCH RE mapping in case of multiple subframe scheduling	WILUS Inc.	Minseok Noh	62848	draftCR		Discussion
R1-1610199	Correction on handling UL LBT procedure under UE power limited case	WILUS Inc.	Minseok Noh	62848	draftCR		Discussion
R1-1610200	Clarification on channel access priority class according to UL LBT type indication in eLLA DCI	WILUS Inc.	Minseok Noh	62848	draftCR		Discussion
R1-1610201	Discussion on UL Multi-carrier Transmission for eLAA	WILUS Inc.	Minseok Noh	62848	other		Discussion
R1-1610202	Discussion on Handling UL Multicarrier Transmission under UE power limited case	WILUS Inc.	Minseok Noh	62848	other		Discussion

R1-1610203	Synchronization in NR considering beam sweeping	ASUSTEK COMPUTER (SHANGHAI)	Eddie Lin	40159	discussion		Decision
R1-1610204	Impact of multiplexing multiple numerologies on initial access	ASUSTEK COMPUTER (SHANGHAI)	Eddie Lin	40159	discussion		
R1-1610205	Discussion on resource assignment and interference handling in TDD NR RAN	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610206	Paging Transmission on Non-Anchor PRB	III	Chun-che Chien	43585	discussion		
R1-1610207	Discussion on System Information Delivery in NR	III	Chun-che Chien	43585	discussion		
R1-1610208	Draft CR for correction on MPDCCH hopping	Qualcomm Incorporated	Peter Gaal	57198	draftCR		Discussion
R1-1610209	On simultaneous transmission of periodic and aperiodic CSI in eLAA	Qualcomm Incorporated	Peter Gaal	57198	discussion		Discussion
R1-1610210	Draft CR on simultaneous transmission of periodic and aperiodic CSI in eLAA	Qualcomm Incorporated	Peter Gaal	57198	draftCR		Discussion
R1-1610211	Way Forward on modulation for NR	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610212	On random resource selection for V2P	Ericsson	Stefano Sorrentino	44504	discussion		
R1-1610213	On Low Latency UL Multiple Access in NR	Ericsson	Stefan Parkvall	28759	discussion		Decision
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R1-1610215	RSTD Reporting Enhancement in OTDOA	Nokia, Alcatel-Lucent Shanghai Bell	Zhilan Xiong	68164	discussion		Decision
R1-1610216	Discussion of PRS-Based Beacon for Indoor Positioning	Nokia, Alcatel-Lucent Shanghai Bell	Zhilan Xiong	68164	discussion		Decision
R1-1610217	Resource assignment for mixed numerologies	Panasonic	Quan Kuang	64589	discussion		
R1-1610218	Some Considerations on HARQ Feedback Mechanism	ZTE	Yifei Yuan	58525	discussion		
R1-1610219	On Flexible Duplexing and Associated Interference Management Techniques	Ericsson	Sorour Falahati	58325	discussion		Decision

R1-1610220	Considerations on handling wrap-around issue in subframe pool configuration for V2V	Innovative Technology Lab Co.	Sung Jun Yoon	58632	other		
R1-1610221	Support of OTDOA in NB-IoT	Innovative Technology Lab Co.	Sung Jun Yoon	58632	other		
R1-1610222	On support of SC-PTM in NB-IoT	Innovative Technology Lab Co., KT Corp.	Sung Jun Yoon	58632	other		
R1-1610223	PRACH for very high speed scenario	Nokia, Alcatel-Lucent Shanghai Bell	Jari Lindholm	7179	discussion		
R1-1610224	Coexistence of DFTsOFDM and OFDM in UL below 40GHz	Mitsubishi Electric RCE	Cristina Ciochina-Duchesne	56339	discussion		Decision
R1-1610225	TR38.900_CR_Section_7.7.5.1	Mitsubishi Electric Co., Fraunhofer HHI	Fumihiro Hasegawa	61720	CR		Decision
R1-1610226	CSI acquisition frameworks for NR MU-MIMO	Mitsubishi Electric Co.	Fumihiro Hasegawa	61720	discussion		
R1-1610227	Nonlinear precoding schemes for NR MU-MIMO and their specification impact	Mitsubishi Electric Co.	Fumihiro Hasegawa	61720	discussion		
R1-1610228	Discussion on time domain structure for CP length	KDDI Corporation	Takeo Ohseki	58533	discussion		
R1-1610229	Performance comparison of nonlinear precoding schemes for NR MU-MIMO	Mitsubishi Electric Co.	Fumihiro Hasegawa	61720	discussion		
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R1-1610231	Initial results for Phase 1 link level MIMO calibration for NR	Mitsubishi Electric Co.	Fumihiro Hasegawa	61720	discussion		
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R1-1610233	On introducing the HS-SCCH orders for enabling TTI Switching in Multicarrier Enhancements in UMTS	Ericsson	Gerardo Medina	58678	other		
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R1-1610238	FC-OFDM discussion based on RAN1#86 agreement	ORANGE	Raphael Visoz	25997	discussion		Discussion
R1-1610239	On beam management in NR - procedures	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610240	Beam managemenet - DCI monitoring	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
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R1-1610242	Frame structure support for DL and UL sweeping subframes	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610243	On procedures for beam selection and feedback signalling	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
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R1-1610284	MIMO link level calibration results	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
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R1-1610302	Discussion on the issue of transmission during the sensing window	Panasonic	Sujuan Feng	44362	discussion		
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R1-1610304	Super-constellation based power ratios and gray mapping for MUST	KT Corp.	Kyu Jin Park	58528	discussion		Decision
R1-1610305	Design aspects of short PUSCH	KT Corp.	Kyu Jin Park	58528	discussion		Decision
R1-1610306	Forward compatible reference signal design requirement for interference mitigation	CEWiT	Chandrasekaran Mohandoss	64252	discussion		Discussion
R1-1610307	Views on time domain structure for NR	KT Corp.	Kyu Jin Park	58528	discussion		
R1-1610308	DraftCR: 36.213 Clarification on the reference subframe k in ECCE determination in a MPDCCH search space	Sony	Martin Beale	59973	draftCR		Discussion
R1-1610309	flexi-OFDMA, a new waveform for NR	CEWiT, IIT-H, IIT-M, Reliance Jio, Tejas Networks	Chandrasekaran Mohandoss	64252	discussion		Discussion

R1-1610310	eMBMS RS Design Considerations	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1610311	eMBMS PSS/SSS/PBCH and SIB1 transmission	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1610312	Considerations on PBCH coverage enhancement	Nokia, Alcatel-Lucent Shanghai Bell	David Bhatoolaul	59768	discussion		Decision
R1-1610313	Correction for correlation modelling for multi-frequency simulations	Ericsson	Mattias Frenne	33019	CR		Decision
R1-1610314	FEC performance comparison for short frame sizes for NR	IMT, ORANGE	Raphael Visoz	25997	discussion		Discussion
R1-1610315	On battery models for mMTC	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1610316	On the evolution of mMTC	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1610317	On the DM-RS structure	Ericsson	Mattias Frenne	33019	discussion		Decision
R1-1610318	Open Items in Synchronization Signal Design	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610319	Beam-based design framework for New Radio	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610320	Random access aspects for beam-based NR initial access	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610321	DL DMRS design for TTI shortening	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610322	sPDCCH search space design	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610323	Design aspects of sPDCCH	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610324	DL control for short TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610325	Design aspects of sPDSCH	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610326	Design aspects of sPUSCH	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610327	sPUSCH sTTI operation	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610328	UCI on sPUSCH with short TTI	Ericsson	Daniel Larsson	39861	discussion		Decision

R1-1610329	Design aspects of sPUCCH	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610330	On reduced processing time for short TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610331	On the operation with different TTI lengths	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610332	TDD aspects of short TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610333	sTTI lengths combination in case of CA	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610334	Asynchronous HARQ for UL retransmissions with short TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610335	Handling overlapping allocations with short and 1 ms TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610336	Puncturing sTTI in legacy TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610337	UL power-related aspects for sTTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610338	Draft LS on UL power control related aspects	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610339	Reduced processing for 1ms TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610340	Fast CSI for 1ms TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610341	HARQ and UL scheduling timings for 1ms TTI and reduced processing time	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610342	PUCCH collisions with reduced processing time for 1ms TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610343	Asynchronous HARQ for PUSCH	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610344	TBS scaling for short TTI	Ericsson	Daniel Larsson	39861	discussion		Decision
R1-1610345	Robust and Efficient Beam Management for NR	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1610346	On the use of exising NB-IoT signals for OTDOA	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1610347	NB-IoT Collision handling in Multicast	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1610348	Power consumption and latency reduction by increasing the maximum NPDSCH transport block sizes and using two HARQ	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1610349	Power consumption and latency reduction by increasing the maximum NPUSCH transport block size and using two HARQ	Ericsson	Yutao Sui	61418	discussion		Decision

R1-1610350	Latency consideration of channel coding candidates for URLLC	National Taiwan University	Jen-Ming Wu	66704	discussion		
R1-1610351	A framework for initial access for NR	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610352	Random access and support for multiple numerologies for NR	INTERDIGITAL COMMUNICATIONS	Paul Marinier	14674	discussion		
R1-1610353	Long Network DTX in NR	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1610354	System information acquisition principle for NR	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1610355	NR IDLE mode operation	Ericsson	Asbjorn Grovlen	45069	discussion		Decision
R1-1610356	Considerations for DL Broadcast Channel	InterDigital Communications	Shahrokh Nayeb Nazar	43012	discussion		
R1-1610357	Unicast control region for FeMBMS carrier	Ericsson	Joerg Huschke	12018	discussion		Decision
R1-1610358	System Information modification indication for FeMBMS carrier	Ericsson	Joerg Huschke	12018	discussion		Decision
R1-1610359	On the utilization of Advanced Receivers in NR	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610360	On the cross-link interference mitigation	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610361	On network energy efficiency requirement and evaluation for the 5G new radio	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610362	Uplink power control for 5G New Radio	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610363	Discussion on subframe bitmap for V2V communication	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610364	Discussion on CSI reporting for hybrid CSI	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610365	Discussion multi-shot CSI-RS	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610366	Discussion on URLLC design aspects	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610367	Considerations on eV2X NR design	Intel Corporation	Seunghee Han	47329	discussion		Decision

R1-1610368	Preliminary eV2X evaluation analysis	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610369	Correction on MPDCCH monitoring in special subframes	Huawei, HiSilicon	Brian Classon	45750	CR		Decision
R1-1610370	Correction on MPDCCH transmission without repetition	Huawei, HiSilicon	Brian Classon	45750	CR		Decision
R1-1610371	Discussion on Sync Signal Design for NR	Convida Wireless LLC	Qing Li	65106	discussion		
R1-1610372	Synchronization on Beamforming Initial Access Operations	Convida Wireless LLC	Qing Li	65106	discussion		
R1-1610373	On VoLTE coverage enhancements based on CE mode A mechanisms	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610374	Support of link adaptation for UL grant-free NOMA schemes	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610375	Coverage performance for UL NOMA schemes	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610376	Summary of current studies on NR Multiple Access	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610377	Channel Coding scheme for EMBB	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610378	Preliminary performance evaluation of different beamforming options for NR synchronization signals	Intel Corporation	Seunghee Han	47329	discussion		Discussion
R1-1610379	On Downlink Control Channel Design for New Radio	Convida Wireless LLC	Qing Li	65106	discussion		
R1-1610380	Discussion on Dynamic Switching of Transmission Modes	Convida Wireless LLC	Qing Li	65106	discussion		
R1-1610381	On OTDOA Positioning for NB-IOT	Fraunhofer IIS	Mohammad Alawieh	65091	discussion		Discussion
R1-1610382	Clarification of PUCCH and SRS not belonging to any narrowband for BL/CE UE	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610383	Multipath RSTD reporting per cell for enhanced indoor positioning	Ericsson, Nokia	Johan Bergman	51222	discussion		Decision
R1-1610384	On combining of CRS and PRS for enhanced indoor positioning	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610385	PRS patterns for PRS-based TBS for enhanced indoor positioning	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610386	On CSI-RSRP reporting support to E-SMLC for enhanced indoor positioning	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610387	Defining indoor/outdoor classification for enhanced indoor positioning	Ericsson	Johan Bergman	51222	discussion		Decision

R1-1610388	Larger max TBS for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610389	Larger max channel bandwidth for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610390	HARQ-ACK bundling for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610391	Number of DL HARQ processes for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610392	Collision handling for multicast support for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610393	L1 configuration for multicast support for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610394	OTDOA enhancements for MTC	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610395	VoLTE enhancements for CE mode A	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610396	PUSCH coverage enhancement for VoLTE	Ericsson	Johan Bergman	51222	discussion		Decision
R1-1610397	OTFS PAPR Analysis	Cohere Technologies	Michail Tsatsanis	62285	discussion		
R1-1610398	Power consumption and latency reduction by increasing the maximum NPDSCH transport block sizes	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1610399	Power consumption and latency reduction by increasing the maximum NPUSCH transport block size	Ericsson	Yutao Sui	61418	discussion		Decision
R1-1610400	On NR DL synchronization	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610401	On NR RACH procedure	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610402	On NR initial access and mobility	Intel Corporation	Seunghee Han	47329	discussion		Decision
R1-1610403	Waveform Simulation Results for Above 40 GH	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610404	FC-OFDM discussion based on RAN1#86 waveform agreements	ORANGE	Hao Lin	65530	discussion		Decision
R1-1610405	DRX and Beam Management	Nokia, Alcatel-Lucent Shanghai Bell	Karri Ranta-aho	64268	discussion		
R1-1610406	Design for larger max PDSCH/PUSCH channel bandwidth	Kyocera Corporation	Amit Kalhan	41305	other		
R1-1610407	Design for larger maximum TBS	Kyocera Corporation	Amit Kalhan	41305	other		

R1-1610408	DraftCR: 36.213 Clarification on the reference subframe k in ECCE determination in a MPDCCH search space	Sony Europe Limited	Shin horng Wong	43248	draftCR		Discussion
R1-1610409	CR on 36.211 NB-IoT PDSCH symbol mapping	Ericsson	Yutao Sui	61418	CR		Decision
R1-1610410	CR on 36.213 NB-IoT Type1 and Type 2 search space definition	Ericsson	Yutao Sui	61418	CR		Decision
R1-1610411	URLLC channel coding	Qualcomm Incorporated	Patrick Merias	52292	discussion		Discussion
R1-1610412	Clarifications about NPRACH configuration parameters	Nokia, Alcatel-Lucent Shanghai Bell	Jorma Kaikkonen	25263	CR		Decision
R1-1610413	Introduction of new Transport Block Size for DL 256QAM	Qualcomm	Patrick Merias	52292	discussion		
R1-1610414	Comparative Power Analysis between UL and DL-based Mobility	Qualcomm Incorporated	Patrick Merias	52292	discussion		Discussion
R1-1610415	Discussion on flexible duplex operations in NR design	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610416	High speed mobility in NR	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	discussion		
R1-1610417	Data Sharing on NR Channel Coding Simulation Results	MediaTek	Patrick Merias	52292	discussion		
R1-1610418	Co-channel coexistence for DSRC and LTE-V2V	Qualcomm Incorporated	Patrick Merias	52292	discussion		Discussion
R1-1610419	UE considerations on coding combination for NR data channels	MediaTek Inc.	Patrick Merias	52292	discussion		
R1-1610420	Resolving Polar code memory complexity issue	MediaTek Inc.	Patrick Merias	52292	discussion		
R1-1610421	Removal of LAA DRS channel access from UL Type 2 Channel Access description	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	draftCR		Discussion
R1-1610422	New Radio MIMO Access Procedures	National Instruments Corp.	Patrick Merias	52292	discussion		Decision
R1-1610423	Summary of Channel Coding Simulation Data Sharing	InterDigital Communications	Patrick Merias	52292	discussion		
R1-1610424	Completing mechanism 1 of hybrid CSI for Rel.14	Samsung	Patrick Merias	52292	other		
R1-1610425	Rapporteur Work Plan on eFD-MIMO	ETSI	Patrick Merias	52292	Work Plan		

R1-1610426	Numerology design and link-level simulation results for high speed scenario	ETRI	Patrick Merias	52292	discussion		
R1-1610427	Discussion of PRS-Based Beacon for Indoor Positioning	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	discussion		Decision
R1-1610428	Correction on periodic CSI reporting mode 2-1 for Class B FD-MIMO	Intel Corporation, ZTE, ZTE Microelectronics	Patrick Merias	52292	draftCR		Discussion
R1-1610429	Discussion on DM-RS design for NR	Intel Corporation	Patrick Merias	52292	discussion		Decision
R1-1610430	Power consumption and latency reduction by increasing the maximum NPDSCH transport block sizes and using two HARQ	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610431	Power consumption and latency reduction by increasing the maximum NPUSCH transport block size and using two HARQ	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610432	Power consumption and latency reduction by increasing the maximum NPDSCH transport block sizes	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610433	Power consumption and latency reduction by increasing the maximum NPUSCH transport block size	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610434	A new system simulator for NB-IoT positioning	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610435	Link level simulation results for NR initial synchronization and cell search	MediaTek Inc.	Patrick Merias	52292	discussion		
R1-1610436	Path loss model for evaluation of mMTC	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610437	Beam grouping for beam management	ZTE, ZTE Microelectronics	Patrick Merias	52292	other		
R1-1610438	Coverage emhancement techniques	Qualcomm Incorporated	Patrick Merias	52292	discussion		Discussion
R1-1610439	Correction of typos due to wrong implementation of CR0283 “Clarification of valid subframe in eMTC”	ETSI	Patrick Merias	52292	CR		Decision
R1-1610440	Draft Agenda of RAN1#86bis meeting	RAN1 Chair	Patrick Merias	52292	agenda		Approval
R1-1610441	On UL waveform - evaluation	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610442	Multi-beam RACH design and evaluation	Qualcomm Incorporated	Patrick Merias	52292	discussion		Discussion

R1-1610443	MIMO LLS calibration results for NR on 30GHz frequency band	Samsung Electronics Co., Ltd	Patrick Merias	52292	other		
R1-1610444	Explicit HARQ and scheduling timing design for LTE shorten TTI	CATT	Yanping Xing	57090	discussion		Decision
R1-1610445	MIMO calibration for NR – system level	InterDigital Communications	Patrick Merias	52292	discussion		
R1-1610446	OTFS PAPR Analysis	Cohere Technologies	Michail Tsatsanis	62285	discussion		
R1-1610447	Correction of PRACH starting subframes for eMTC	Intel Corporation	Patrick Merias	52292	draftCR		Discussion
R1-1610448	System-level analysis of UL NOMA schemes	Intel Corporation	Patrick Merias	52292	discussion		
R1-1610449	void	ETSI	Patrick Merias	52292	other		
R1-1610450	Correction on CWp adjustment on Type B1 multi-carrier access procedure for Rel-13 LAA	WILUS Inc.	Patrick Merias	52292	CR		Decision
R1-1610451	Correction on NZP CSI-RS aggregation for Class A	LG Electronics, Samsung	Patrick Merias	52292	CR		Decision
R1-1610452	Correction to PUCCH reporting mode 2-1	Intel Corporation, ZTE Corporation, ZTE Microelectronics	Patrick Merias	52292	CR		Decision
R1-1610453	Correction to PUCCH reporting mode 1-1	Intel Corporation, ZTE Corporation, ZTE Microelectronics	Patrick Merias	52292	CR		Decision
R1-1610454	Correction to PUCCH reporting mode 2-1	Intel Corporation, ZTE Corporation, ZTE Microelectronics	Patrick Merias	52292	CR		Decision
R1-1610455	Correction to PUCCH reporting mode 1-1	Intel Corporation, ZTE Corporation, ZTE Microelectronics	Patrick Merias	52292	CR		Decision
R1-1610456	Correction on UL grant reception in ending partial subframe	LG Electronics	Patrick Merias	52292	CR		Decision

R1-1610457	Correction on UL burst scheduling	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1610458	CR on PHICH operation for eLAA in 36.213	Huawei, HiSilicon	Patrick Merias	52292	CR		Decision
R1-1610459	Corrections to RV in eLAA DCI definitions	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	CR		Decision
R1-1610460	Correction on handling UL LBT procedure under UE power limited case	WILUS Inc.	Patrick Merias	52292	CR		Decision
R1-1610461	PSSCH/PSBCH decoding issue	CATT	Patrick Merias	52292	discussion		Decision
R1-1610462	Draft CR on energy detection threshold for DL multi-carrier operation for LAA in 36.213	Huawei, HiSilicon	Patrick Merias	52292	draftCR		Discussion
R1-1610463	Draft CR on DCI formats related with LAA in TS 36.212	ETRI	Patrick Merias	52292	draftCR		Discussion
R1-1610464	Draft CR on UL duration and offset field in TS 36.213	ETRI	Patrick Merias	52292	draftCR		Discussion
R1-1610465	Way Forward on DMRS randomization	Samsung	Patrick Merias	52292	discussion		
R1-1610466	Way Forward on resource reselection	Samsung, CATT	Patrick Merias	52292	discussion		
R1-1610467	Correction on equation for MPDCCH search space and starting subframe position	NTT DOCOMO, INC., Panasonic	Patrick Merias	52292	draftCR		Discussion
R1-1610468	Way Forward on collision issue on SC-PTM for eNB-IoT	LG Electronics	Patrick Merias	52292	discussion		
R1-1610469	Way Forward on SC-PTM configuration for eNB-IoT	LG Electronics	Patrick Merias	52292	discussion		
R1-1610470	Way Forward on paging PRB configuration for eNB-IoT	LG Electronics	Patrick Merias	52292	discussion		
R1-1610471	CR for clarification on NPRACH and NPUSCH collision	Qualcomm Incorporated	Patrick Merias	52292	draftCR		Discussion
R1-1610472	Evaluation of Adjusted-Min-Sum LDPC Decoder and Complexity Aspects of Permutation Networks	Huawei, HiSilicon	Patrick Merias	52292	discussion		
R1-1610473	UCI on sPUSCH with short TTI	Ericsson	Patrick Merias	52292	discussion		Decision

R1-1610474	Correction on equation for MPDCCH search space and starting subframe position	NTT DOCOMO, INC., Panasonic	Patrick Merias	52292	draftCR		Discussion
R1-1610475	CR on start timing of PUSCH	Samsung	Patrick Merias	52292	CR		Decision
R1-1610476	CR on DCI formats related with LAA in TS 36.212	ETRI	Patrick Merias	52292	CR		Decision
R1-1610477	Way Forward on UE background sensing	NTT DOCOMO, Panasonic	Patrick Merias	52292	discussion		
R1-1610478	Further LLS results for UL non-orthogonal multiple access	Fujitsu	Patrick Merias	52292	other		
R1-1610479	TR38.900_CR_Section_7.6.2.2	Fraunhofer HHI, Samsung, Ericsson, Intel, Nokia, InterDigital	Leszek Raschkowski	57944	CR		Decision
R1-1610480	Dynamic TDD in dense urban scenario	NTT DOCOMO, INC.	Patrick Merias	52292	discussion		
R1-1610481	void	ETSI	Patrick Merias	52292	discussion		Decision
R1-1610482	Way Forward on NR frame structure	NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610483	Way Forward on RB grid definition for mixed numerologies - FDM	ZTE, ZTE Microelectronics, Ericsson, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic, Convida Wireless	Patrick Merias	52292	discussion		Decision
R1-1610484	Way Forward on coordinated transmission schemes in NR	LG Electronics, Intel Corporation, Samsung	Patrick Merias	52292	discussion		Decision

R1-1610485	Way Forward on Waveform for NR Uplink	Qualcomm, Orange, OPPO, ZTE, ZTE Microelectronics, InterDigital, MediaTek, LGE, IITH, Idaho National Lab, Mitsubishi, Panasonic, Vivo, Tejas Networks, IITM, CEWIT, Straight Path, NTU, Kyocera, Samsung, Spreadtrum, Reliance-jio, Sharp, AT&T, Xiaomi, Sony, NEC, Motorola, Lenovo, National Instrument, Apple	Patrick Merias	52292	discussion		Decision
R1-1610486	Way Forward on Spatial Multiplexing Schemes for MU-MIMO	Mitsubishi Electric, InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610487	Way Forward on beam management	Ericsson, Intel, CATT, InterDigital Communications	Patrick Merias	52292	discussion		Decision
R1-1610488	Way Forward on wider BW operation for NR	NTT DOCOMO, AT&T	Patrick Merias	52292	discussion		Decision
R1-1610489	Way Forward on RACH procedure for multi-beam operation	NTT DOCOMO, ETRI, Qualcomm, Nokia, Alcatel-Lucent Shanghai-Bell, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610490	Way Forward on NR CSI-RS	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610491	Way Forward on NR DMRS	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610492	Way Forward on the CSI-RS configuration for NR	Intel Corporation, Samsung, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610493	CR clarification on spectral efficiency	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision

R1-1610494	CR for clarification on A-CSI without hopping	Qualcomm Incorporated, Samsung	Patrick Merias	52292	CR		Decision
R1-1610495	CR clarification on spectral efficiency	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1610496	CR for clarification on A-CSI without hopping	Qualcomm Incorporated, Samsung	Patrick Merias	52292	CR		Decision
R1-1610497	Correction on equation for MPDCCH search space and starting subframe position	NTT DOCOMO, INC., Panasonic	Patrick Merias	52292	CR		Decision
R1-1610498	Way Forward on NR initial access sgnals/channels	NTT DOCOMO, Intel Corporation, Ericsson, Qualcomm, InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610499	Performance evaluation results on NR synchronization signals	NTT DOCOMO, INC.	Patrick Merias	52292	discussion		Decision
R1-1610500	Way Forward on numerology for forward compatibility	InterDigital, Mitsubishi, Nokia, Alcatel-Lucent Shanghai Bell, Intel	Patrick Merias	52292	discussion		Decision
R1-1610501	Correction on equation for MPDCCH search space and starting subframe position	NTT DOCOMO, INC., Panasonic	Patrick Merias	52292	CR		Decision
R1-1610502	Way Forward on symbol level alignments	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610503	Way Forward on Alignments among different numerologies in frequency domain	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610504	Correction to DMRS for MPDCCH associated with P-RNTI	Virtuosys Limited, Qualcomm Incorporated, Intel Corporation	Patrick Merias	52292	CR		Decision
R1-1610505	Clarification on NPRACH and NPUSCH collision	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1610506	Clarification on NPRACH and NPUSCH collision	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1610507	Way Forward on Resource Reservation	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610508	[Draft] LS on wider bandwidth operation for NR	NTT DOCOMO	Patrick Merias	52292	LS out		Decision
R1-1610509	Way Forward on CSI-RS and CSI reporting in NR	LG Electronics, Ericsson, Intel	Patrick Merias	52292	discussion		Decision

R1-1610510	Way Forward on Beam reporting for NR	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610511	Way Forward on Beam management for DL control channel	ZTE, ZTE Microelectronics , Intel, Xinwei	Patrick Merias	52292	discussion		Decision
R1-1610512	Way Forward on Group-based beam management	ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610513	Way Forward on QCL for NR	ZTE Corporation, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610514	Way Forward on reference signal for demodulation	ZTE Corporation, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610515	Way Forward on CSI reporting for NR	Samsung, Intel, Ericsson, Xinwei	Patrick Merias	52292	discussion		Decision
R1-1610516	Way Forward on Beam management RS	Samsung, Intel, Verizon Wireless	Patrick Merias	52292	discussion		Decision
R1-1610517	Way Forward on CSI measurement and reporting	Huawei, HiSilicon, Ericsson, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610518	Way Forward on DL MIMO transmission	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610519	Way Forward on MIMO transmission based on multiple antenna panels	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610520	Way Forward on the QCL for NR	Intel Corporation, LGE	Patrick Merias	52292	discussion		Decision
R1-1610521	Way Forward on subframe duration	ZTE, ZTE Microelectronics,Ericsson, NTT Docomo, Nokia Qualcomm, Panasonic, CATT, Mediatek, Convida Wireless	Patrick Merias	52292	discussion		Decision
R1-1610522	Way Forward on unified structure of DL sync signal	Intel Corporation, NTT DOCOMO, ZTE, ZTE Microelectronics, ETRI, InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610523	Way Forward on coordination schemes in NR	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610524	Way Forward on RS definition	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1610525	Way Forward on UL MIMO	CATT	Patrick Merias	52292	discussion		Decision
R1-1610526	Way Forward on UL link adaptation procedures in NR	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610527	Way forward on CRS usage together with PRS	Intel Corporation, Acorn Technologies, Huawei, HiSilicon, Sony	Patrick Merias	52292	discussion		Decision
R1-1610528	Way Forward on support of UL non-orthogonal multiple access	Huawei, HiSilicon, Convida Wireless, Interdigital	Patrick Merias	52292	discussion		Decision
R1-1610529	Way Forward on support of UL grant-free	Huawei, HiSilicon, CATT, Convida Wireless, Interdigital	Patrick Merias	52292	discussion		Decision
R1-1610530	Summary of preliminary LLS results	Huawei, HiSilicon	Patrick Merias	52292	other		
R1-1610531	Summary of preliminary SLS results	Huawei, HiSilicon	Patrick Merias	52292	other		
R1-1610532	Way Forward on compensation of phase rotation and frequency offset	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610533	Way Forward on CSI framework for NR	Samsung, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610534	Way Forward on PMI reporting for NR	Samsung, AT&T, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610535	Way Forward on CSI feedback framework for hybrid beamforming in NR	CMCC	Patrick Merias	52292	discussion		Decision
R1-1610536	Evaluation Assumptions for NR Network Coordination	Samsung, Intel, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610537	Way Forward on Network Coordination Framework	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610538	Way forward on SYNC periodicity	Qualcomm Incorporated	Patrick Merias	52292	discussion		Decision
R1-1610539	Way Forward on Beam management	CATT	Patrick Merias	52292	discussion		Decision
R1-1610540	Way Forward on slot	NTT DOCOMO, INC., Ericsson, Panasonic, Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1610541	Performance Evaluation for NR Channel Coding	Huawei, HiSilicon	Patrick Merias	52292	other		
R1-1610542	Way Forward on maximum TA restriction for 1ms TTI processing time reduction	Qualcomm Incorporated	Patrick Merias	52292	discussion		Decision
R1-1610543	Way Forward on not supporting N+2 in 1ms TTI processing time reduction	Qualcomm, CATT, Samsung, Huawei, HiSilicon, Intel, MTK, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610544	Observations on channel codes for NR eMBB data	AccelerComm	Patrick Merias	52292	discussion		Decision
R1-1610545	Way Forward on channel codes for NR eMBB data	AccelerComm	Patrick Merias	52292	discussion		Decision
R1-1610546	Way Forward on bandwidth adapatation in NR	MediaTek, Acer, CHTTL, III, Panasonic, Ericsson, AT&T, Nokia, ASB, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610547	Way Forward on timing relationship for NR	MediaTek, III, Samsung, NTT Docomo, Nokia, ASB, Qualcomm, Ericsson, Huawei, HiSilicon, Sony	Patrick Merias	52292	discussion		Decision
R1-1610548	Way Forward on sTTI scheduling options	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610549	Way Forward on handling of overlapping PDSCH/sPDSCH and PUSCH/sPUSCH	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610550	Way Forward on multiplexing of Sync and Broadcast signals	Qualcomm Incorporated, CATT	Patrick Merias	52292	discussion		Decision
R1-1610551	Way Forward on NB IoT SC-PTM scheduling	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610552	Way Forward on NB IoT SC-MTCH transmission	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610553	Way Forward on NB IoT multicast collision handling	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610554	Way Forward on the Presence of NRS on Non-anchor PRBs	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610555	Way Forward on Paging in non-anchor PRBs	Ericsson	Patrick Merias	52292	discussion		Decision

R1-1610556	DCI design to support multiple SPS configurations	CATT	Patrick Merias	52292	discussion		Decision
R1-1610557	Way Forward on supporting n+2 minimum timing for shortened processing time in 1ms TTI	Nokia, Alcatel-Lucent Shanghai Bell, Ericsson, NTT DoCoMo, Sharp	Patrick Merias	52292	discussion		Decision
R1-1610558	Way Forward on Synchronization signal for NR initial access	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610559	Way Forward on NR RACH design	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610560	Way Forward on Antenna Port Layouts and Oversampling Factors	Ericsson, Sprint, Verizon, DOCOMO, Deutsche Telekom, ATT, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610561	Way Forward on fallback mechanisms for shortened processing time in 1ms TTI	LG Electronics, Ericsson, Intel, Qualcomm, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610562	Way Forward on UL scheduling timing for FS2 with shortened processing time in 1ms TTI	LG Electronics, NTT DOCOMO, Ericsson, ZTE Corp, ZTE Microelectronics, Intel	Patrick Merias	52292	discussion		Decision
R1-1610563	Way Forward on short TTI structure	LG Electronics, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610564	Way Forward on sPUCCH design	LG Electronics, ZTE Corp, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610565	LS on Multi-carrier enhancements for UMTS	RAN2, Ericsson	Patrick Merias	52292	LS in		
R1-1610566	Way Forward on NR UL control channel	Samsung, Qualcomm, Intel, Panasonic, InterDigital, Sony, Ericsson, NTT DOCOMO, Fujitsu	Patrick Merias	52292	discussion		Decision
R1-1610567	Way Forward on multiplexing of sync signal	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610568	Way Forward on DL HARQ-ACK timing for FS2	Samsung	Patrick Merias	52292	discussion		Decision

R1-1610569	Way Forward on sTTI length	Samsung, Panasonic, Qualcomm, Sharp, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610570	Way forward on IFDMA based DMRS	Intel, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610571	LS reply on Multi-carrier enhancements for UMTS	RAN1, Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610572	LS to RAN2/3 on RAN1 progress on MC enhancements	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1610573	Report of the UMTS sessions	UMTS Session Chairman's Notes (Huawei)	Patrick Merias	52292	other		Endorsement
R1-1610574	void	ETSI	Patrick Merias	52292	other		
R1-1610575	void	ETSI	Patrick Merias	52292	other		
R1-1610576	void	ETSI	Patrick Merias	52292	other		
R1-1610577	void	ETSI	Patrick Merias	52292	other		
R1-1610578	void	ETSI	Patrick Merias	52292	other		
R1-1610579	void	ETSI	Patrick Merias	52292	other		
R1-1610580	Performance Evaluation for NR Channel Coding	Huawei, HiSilicon	Patrick Merias	52292	other		
R1-1610581	Way Forward on handling of PUSCH and sPUSCH grants for the same subframe and carrier	Ericsson, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610582	Way Forward on sTTI scheduling options	Ericsson, Panasonic, Samsung, Nokia, ASB, ZTE, ZTE Microelectronics, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610583	Way Forward on sTTI scheduling options	Ericsson, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610584	[DRAFT] LS On Shortened TTI and processing time for LTE	Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610585	[DRAFT] LS on implication of sTTI operation on UL ON/OFF time mask	Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610586	Session Notes	Ericsson	Patrick Merias	52292	other		

R1-1610587	void	ETSI	Patrick Merias	52292	other		
R1-1610588	void	ETSI	Patrick Merias	52292	other		
R1-1610589	void	ETSI	Patrick Merias	52292	other		
R1-1610590	Way Forward on Evaluation scenarios and assumptions for DL mobility at above-6GHz	Samsung, Intel, Qualcomm	Patrick Merias	52292	other		
R1-1610591	WF on UL DMRS	Nokia, Alcatel-Lucent Shanghai, NEC	Patrick Merias	52292	discussion		Decision
R1-1610592	WF on transmission scheme for semi-open loop	CATT, Samsung, Nokia, Alcatel-Lucent Shanghai Bell, Intel	Patrick Merias	52292	discussion		Decision
R1-1610593	WF on aggregation for non-precoded CSI-RS	ZTE, ZTE Microelectronics, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610594	Way Forward on Signalling Details for CSI-RS Overhead Reduction	Samsung, InterDigital, ZTE, Ericsson, DoCoMo	Patrick Merias	52292	discussion		Decision
R1-1610595	Way Forward on Nk and Mk for {20, 28}-port CSI-RS	Samsung, LGE, CATT, Nokia, ASB, InterDigital, Intel	Patrick Merias	52292	discussion		Decision
R1-1610596	Way Forward on CSI-RS design for CDM-4 and CDM-8	LG Electronics, Ericsson, Qualcomm, CATT	Patrick Merias	52292	discussion		Decision
R1-1610597	WF on downlink control signaling for IFDMA based DMRS	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610598	WF on transmission scheme for semi-open loop	CATT	Patrick Merias	52292	discussion		Decision
R1-1610599	void	ETSI	Patrick Merias	52292	other		
R1-1610600	Updated Summary of Channel Coding Simulation Data Sharing for eMBB Data Channel	InterDigital Communications	Patrick Merias	52292	discussion		Decision
R1-1610601	Way Forward on Signalling Details for CSI-RS Overhead Reduction	Samsung, ZTE, Ericsson, DoCoMo, InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610602	Way Forward on Signalling Details for CSI-RS Overhead Reduction	Samsung, ZTE, Ericsson, DoCoMo, InterDigital	Patrick Merias	52292	discussion		Decision

R1-1610603	WF on MU-CQI Enhancement	NTT DOCOMO, Qualcomm, Samsung, NEC, Xinwei	Patrick Merias	52292	discussion		Decision
R1-1610604	WF on channel codes for NR eMBB data	AccelerComm, Ericsson, Orange, IMT, LG, NEC, Sony, LG Uplus	Patrick Merias	52292	discussion		Decision
R1-1610605	[DRAFT] LS regarding agreements for FeMBMS	Qualcomm	Patrick Merias	52292	LS out		Decision
R1-1610606	Draft LS for Voice and Video enhancement for LTE	Huawei	Patrick Merias	52292	LS out		Decision
R1-1610607	Way Forward on Channel Coding	ZTE, ZTE Microelectronics, Acer, Bell, CATR, China Unicom, China Telecom, CHTTL, Coolpad, Deutsche Telekom, Etisalat, Huawei, HiSilicon, InterDigital, III, ITRI, MediaTek, Nubia Technology, Neul, OPPO, Potevio, Shanghai Tejet, Spreadtrum, TD Tech, Telus, Vivo, Xiaomi, Xinwei, IITH, IITM, CEWiT, Reliance Jio, Tejas Network	Patrick Merias	52292	discussion		Decision
R1-1610608	void	ETSI	Patrick Merias	52292	other		
R1-1610609	Chairman's Notes of Agenda Item 7.2.2 Enhancements on Full-Dimension (FD) MIMO for LTE	Session Chairmen (Samsung, Nokia)	Patrick Merias	52292	discussion		Endorsement
R1-1610610	Chairman's Notes of Agenda Item 7.2.2 Enhancements on Full-Dimension (FD) MIMO for LTE	Session Chairmen (Samsung, Nokia)	Patrick Merias	52292	discussion		Endorsement
R1-1610611	Way Forward on RPF-4 support in uplink DMRS	Huawei, HiSilicon, Nokia, ASB	Patrick Merias	52292	discussion		Decision

R1-1610612	Way Forward on sequence collision handling in uplink DMRS	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610613	Way Forward on CSI feedback for DMRS based open loop transmission	Huawei, HiSilicon, CATT	Patrick Merias	52292	discussion		Decision
R1-1610614	Way Forward on downlink control signaling for PDSCH rate matching	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610615	Way Forward on supporting aperiodic CSI-RS with one resource	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610616	Way Forward on DL DMRS for sTTI	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610617	Way Forward on UL DMRS indication for sTTI	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610618	Way Forward on sDCI	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610619	Way Forward on sPUCCH formats	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610620	Way Forward on sPUCCH patterns	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610621	Way Forward on PRS Frequency Hopping for OTDOA	Sony, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610622	Way Forward on DC subcarrier	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610623	Way Forward on CSI-RS Density Values for Class A	Ericsson, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610624	Way Forward on CSI-RS Overhead Reduction for Class A	Ericsson, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610625	Way Forward on TP Structure for NR Multiple Access in TR 38.802	ZTE, ZTE Microelectronics, Qualcomm Inc	Patrick Merias	52292	discussion		Decision
R1-1610626	Way Forward on Physical layer abstraction method for MMSE-SIC/PIC receiver	ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610627	Way Forward on technique(s) to handle cross-link interference in flexible duplex	LG Electronics, Panasonic, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610628	Long Network DTX in NR	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610629	Way Forward on aggregation for NP CSI-RS	ZTE, ZTE Microelectronics, Qualcomm	Patrick Merias	52292	discussion		Decision

R1-1610630	Way Forward on RRC reconfiguration for FeMTC features	Qualcomm, Ericsson, Sony, Sequans, DOCOMO, Virtuosys, Sierra Wireless, Kyocera	Patrick Merias	52292	discussion		Decision
R1-1610631	Way forward on NR HARQ	Intel, Nokia, ASB, AT&T, OPPO, MediaTek	Patrick Merias	52292	discussion		Decision
R1-1610632	Way Forward on PDSCH rate matching for supporting aperiodic CSIRS	LGE	Patrick Merias	52292	discussion		Decision
R1-1610633	Way Forward on phase continuity of DL precodong	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610634	Evaluation of flexible duplex in dense urban scenario	Huawei, HiSilicon	Patrick Merias	52292	other		
R1-1610635	Way Forward on Aperiodic CSI-RS for eFD-MIMO	Samsung, CATT, LG Electronics, Nokia, Alcatel-Lucent Shanghai Bell, ZTE, ZTE Microelectronics, InterDigital, Xinwei, Huawei, HiSilicon, KT Corporation, AT&T, Mitsubishi Electric, Straight Path, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610636	Way Forward on Advanced CSI Codebook for eFD-MIMO	Samsung, NTT DOCOMO, KT Corporation, AT&T, Mitsubishi Electric, Straight Path, NEC	Patrick Merias	52292	discussion		Decision
R1-1610637	Way Forward on CSI Framework for NR	Samsung, Ericsson, AT&T, KT Corporation, CATT	Patrick Merias	52292	discussion		Decision
R1-1610638	Way Forward on PMI Reporting for NR	Samsung, AT&T, Ericsson, NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610639	Way Forward on configurations of time resources for NPRS	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1610640	Way Forward on configuration of NPRS transmission on multiple NB-IoT carriers	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610641	Way Forward on configuration of NPRS power for NB-IoT downlink positioning	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610642	Way Forward on SC-MTCH transmission for NB-IoT SC-PTM	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610643	Way Forward on SC-MCCH transmission for NB-IoT SC-PTM	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610644	Way Forward on search space design for SC-PTM in NB-IoT	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610645	Way Forward on timing relationships of 2 HARQ processes for NB-IoT enhancement	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610646	Way Forward on subcarrier spacing selection and switching	ETRI	Patrick Merias	52292	discussion		Decision
R1-1610647	Way Forward on SRS Carrier-based Switching	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610648	Clarification of number of repetitions of PUCCH	ZTE, Rohde & Schwarz	Patrick Merias	52292	CR		Decision
R1-1610649	Clarification on nrs-Power related description	ZTE	Patrick Merias	52292	CR		Decision
R1-1610650	Way Forward on larger PDSCH/PUSCH channel bandwidth for MTC	ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610651	Way Forward on HARQ bundling in HD-FDD for MTC	ZTE, ZTE Microelectronics, Sony, Lenovo, NTT Docomo, Sierra Wireless, Sequans	Patrick Merias	52292	discussion		Decision
R1-1610652	Way Forward on symbol level alignments	LG Electronics, NTT DOCOMO, Ericsson, Panasonic, Qualcomm, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610653	Correction on channel access priority class according to UL LBT type indication in eLAA	WILUS Inc.	Patrick Merias	52292	draftCR		Decision
R1-1610654	Way Forward on OTDOA for eMTC	ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610655	LS on wider bandwidth operation for NR	RAN1, NTT DOCOMO	Patrick Merias	52292	LS out		Decision
R1-1610656	Clarification of number of repetitions of PUCCH	ZTE, Rohde & Schwarz	Patrick Merias	52292	CR		Decision

R1-1610657	Clarification on nrs-Power related description	ZTE	Patrick Merias	52292	CR		Decision
R1-1610658	Way Forward on beam management	Ericsson, Samsung, Intel	Patrick Merias	52292	discussion		Decision
R1-1610659	Evaluation on channel coding candidates for eMBB control channel_Figures	ZTE	Patrick Merias	52292	discussion		Decision
R1-1610660	Evaluation on channel coding candidates for uRLLC and mMTC	ZTE	Patrick Merias	52292	discussion		
R1-1610661	Way Forward on DCI for higher data rates in FeMTC	Ericsson, Qualcomm, Sony, NTT DoCoMo, Intel, Kyocera, KT Corp., Sierra Wireless	Patrick Merias	52292	discussion		Decision
R1-1610662	Way Forward on retuning symbols in FeMTC	Ericsson, NEC, Sequans, Sierra Wireless	Patrick Merias	52292	discussion		Decision
R1-1610663	Way Forward on TBS for FeMTC	Ericsson, Qualcomm, Sony	Patrick Merias	52292	discussion		Decision
R1-1610664	Way Forward on FeMTC SC-PTM scheduling	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610665	Way Forward on FeMTC multicast collision handling	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610666	Way Forward on FeMTC SC-MTCH transmission	Ericsson, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610667	Channel Coding Observations	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610668	Way Forward on Channel Coding	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610669	Way Forward on flexible duplex	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610670	Way Forward on supporting 10 HARQ processes	Sequans, Intel, Sony, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610671	Way Forward on NR DL Control	ZTE, ZTE Microelectronics, Ericsson, Qualcomm, InterDigital	Patrick Merias	52292	discussion		Decision

R1-1610672	Way Forward on the SLSS Transmission	Huawei, HiSilicon, Qualcomm , LG Electronics, Ericsson, Samsung, CATT, ITRI, NTT DOCOMO, OPPO, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610673	Way Forward on Sync Priority for OOC	Huawei, HiSilicon, LG Electronics, Qualcomm, ZTE, ITRI, DCM, Xinwei, Samsung, NEC, CATT, Ericsson, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610674	Way Forward on UL beam management	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610675	Way Forward on UL MIMO transmission	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610676	Way Forward on UCI transmission for NR	LG Electronics, Intel	Patrick Merias	52292	discussion		Decision
R1-1610677	Way Forward on common control channel for NR	LG Electronics, Nokia	Patrick Merias	52292	discussion		Decision
R1-1610678	Efficient Channel Coding Implementations for EMBB	Qualcomm Incorporated	Patrick Merias	52292	discussion		Discussion
R1-1610679	CR to capture additional feature calibration results	Samsung	Patrick Merias	52292	CR		Decision
R1-1610680	LS on TTI switching for MC enhancements	RAN2, Huawei	Patrick Merias	52292	LS in		
R1-1610681	Way Forward on coexistence between NR and LTE	LG Electronics, AT&T	Patrick Merias	52292	discussion		Decision
R1-1610682	Channel Coding scheme for EMBB	Intel Corporation	Patrick Merias	52292	discussion		Decision
R1-1610683	Discussion points on DL control signaling	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610684	Way Forward on supporting larger channel bandwidth for Rel-14 non-BL UEs	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610685	Way Forward on UL MIMO	CATT, Samsung, LG, InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610686	Way Forward on TR structure for NR multiple access	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	discussion		Decision
R1-1610687	Clarification on IF-HARQ for PC-Polar	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1610688	Full calibration results for channel model above 6GHz	Lenovo, Motorola Mobility	Patrick Merias	52292	discussion		Decision
R1-1610689	Way forward on eMBB data channel coding	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610690	Way forward on observations for eMBB data channel coding	Samsung, Qualcomm Incorporated, Nokia, ASB, KT Corporation, Intel Corporation	Patrick Merias	52292	discussion		Decision
R1-1610691	Way Forward on Channel Coding Design for NR	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610692	Way Forward on Further Evaluation Assumptions of Control Channel	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610693	Way Forward on Basics of LDPC Design	Ericsson, Intel, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610694	Way Forward on NR UL MIMO precoding	Intel Corporation, NTT DoCoMo, Fujitsu, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610695	Way Forward on HARQ timing for PUSCH UpPTS	CMCC	Patrick Merias	52292	discussion		Decision
R1-1610696	Way Forward on DMRSfor PUSCH UpPTS	CMCC	Patrick Merias	52292	discussion		Decision
R1-1610697	Way Forward on timing design for TTI bundling	CMCC	Patrick Merias	52292	discussion		Decision
R1-1610698	Way Forward on TBS scalling design for PUSCH UpPTS	CMCC	Patrick Merias	52292	discussion		Decision
R1-1610699	TR38.900_CR_Azimuthal_Angle_Notation	Fraunhofer HHI	Patrick Merias	52292	CR		Decision
R1-1610700	TR38.900_CR_Harmonizing_Terminology	Fraunhofer HHI	Patrick Merias	52292	CR		Decision
R1-1610701	TR36.873_CR_Section_7.3	Fraunhofer HHI	Patrick Merias	52292	CR		Decision
R1-1610702	TR36.873_CR_LOS_Probability	Fraunhofer HHI	Patrick Merias	52292	CR		Decision
R1-1610703	TR36.814_CR_Section_B.1.2.2.1	Fraunhofer HHI	Patrick Merias	52292	CR		Decision
R1-1610704	TR36.814_CR_LOS_Probability	Fraunhofer HHI	Patrick Merias	52292	CR		Decision
R1-1610705	Way Forward on CSI-RS pooling	Ericsson, Samsung, LGE	Patrick Merias	52292	discussion		Decision
R1-1610706	Way Forward on DCI format for SC-PTM	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1610707	Way Forward on SC-PTM configuration and scheduling	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610708	Way Forward on handling multiplexing V2V with other signals/channels	LG Electronics, Samsung, Intel	Patrick Merias	52292	discussion		Decision
R1-1610709	Way Forward on prioritization of SL TX over UL TX	LG Electronics, NTT DOCOMO, ZTE, NOKIA, Alcatel-Lucent Shanghai Bell, CATT, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610710	Discussion on DL control channels	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610711	Way Forward on the pre-defined SLSS IDs for the GNSS timing	Huawei, HiSilicon, ZTE, Samsung, ITRI, CATT, LG Electronics, NTT DOCOMO, Qualcomm, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610712	Way Forward on dynamic resource sharing between eMBB and URLLC in DL	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610713	Way Forward on supporting traffic with small periodicity for LTE-V2X	Huawei, HiSilicon, LG Electronics, Qualcomm, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610714	Way Forward on Principle of Generating Power Ratio	ZTE, ZTE Microelectronics, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610715	Way Forward on the Gray conversion	LG Electronics, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610716	Way Forward on CSI-RS and CSI reporting in NR	LG Electronics, Ericsson, Intel, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610717	Way Forward on additional offset in path-loss model for flexible duplex	LG Electronics, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610718	Way Forward on the overhead reduction for Class B CSI-RS	Intel Corporation	Patrick Merias	52292	discussion		Decision
R1-1610719	Way Forward on evaluation assumptions for compensation of phase rotation and frequency offset	LG Electronics, InterDigital, KT, Huawei	Patrick Merias	52292	discussion		Decision
R1-1610720	Way Forward on URLLC System Level Evaluation Methodology	Intel, Qualcomm, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision

R1-1610721	Way Forward on UL link adaptation procedures in NR	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610722	Way forward on SYNC periodicity	Qualcomm Incorporated	Patrick Merias	52292	discussion		Decision
R1-1610723	Way Forward on Gray Mapped Composite Constellation in MUST	MediaTek, Qualcomm, Nokia, ASB, ITRI	Patrick Merias	52292	discussion		Decision
R1-1610724	Way Forward on Power Ratio in MUST Cases 1 and 2	MediaTek, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610725	Way Forward on DMRS based Transmission Scheme of MUST Case 3	MediaTek, ZTE, ZTE Microelectronics, CMCC	Patrick Merias	52292	discussion		Decision
R1-1610726	Way Forward on PDSCH Starting Symbol in MUST	MediaTek, ZTE, ZTE Microelectronics, Nokia, ASB, ITRI, CMCC	Patrick Merias	52292	discussion		Decision
R1-1610727	Way Forward on CSI feedback framework for hybrid beamforming in NR	CMCC, ZTE, ZTE Microelectronics, CATT, Xinwei	Patrick Merias	52292	discussion		Decision
R1-1610728	Way Forward on ITS Coexistence Mechanisms	Ericsson, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610729	Way Forward on PDSCH starting symbol	LG Electronics, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610730	Way Forward on new DCI design	LG Electronics, LG Uplus, MediaTek, ZTE, ZTE Microelectronics, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610731	Way Forward on PUSCH CSI reporting for hybrid CSIRS mechanism	LG Electronics, Samsung, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610732	Way Forward on QCL issue for aperiodic CSIRS	LG Electronics, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610733	CR on 36.213 NB-IoT Type1 and Type 2 search space definition	Ericsson	Patrick Merias	52292	CR		Decision
R1-1610734	CR on 36.213 NB-IoT Type1 and Type 2 search space definition	Ericsson	Patrick Merias	52292	CR		Decision

R1-1610735	Way Forward on Network Coordination for Advanced Receivers	Samsung, Intel, MediaTek, Orange, Vodafone, IITH, Tejas Networks, IITM, KDDI, CeWiT, Reliance Jio	Patrick Merias	52292	discussion		Decision
R1-1610736	Summary of offline discussion on downlink control channels	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610737	Support of URLLC in UL	Huawei, HiSilicon	Patrick Merias	52292	other		
R1-1610738	Way Forward on compensation of phase rotation and frequency offset for CP-OFDM	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610739	Way Forward on P-UE sensing timeline in partial sensing	Huawei, HiSilicon, NTT Docomo	Patrick Merias	52292	discussion		Decision
R1-1610740	Way Forward on V2V PC5 SLSS transmission	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610741	Way Forward on CSI-RS design for CDM-4 and CDM-8	LG Electronics, Ericsson, Qualcomm, CATT, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610742	Clarification on i_0 value	Qualcomm Incorporated	Patrick Merias	52292	draftCR		Discussion
R1-1610743	Way Forward on UL grant-free workplan	Huawei, HiSilicon, CMCC	Patrick Merias	52292	discussion		Decision
R1-1610744	Way Forward on non-orthogonal MA workplan	Huawei, HiSilicon, CMCC	Patrick Merias	52292	discussion		Decision
R1-1610745	Way Forward on summary of UL non-orthogonal MA progress	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610746	Way Forward on summary of grant-free progress	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610747	Way Forward on RS for Phase Tracking for CP-OFDM	Huawei, HiSilicon, LG Electronics, Samsung, NTT DOCOMO, INC., Intel	Patrick Merias	52292	discussion		Decision
R1-1610748	Draft LS on power allocation for SC-PTM	Huawei	Patrick Merias	52292	LS out		Decision
R1-1610749	Way Forward on PUCCH and SRS not belonging to any narrowband for BL/CE UE	Ericsson, Intel, Qualcomm, Sequans, Sony, ZTE	Patrick Merias	52292	discussion		Decision

R1-1610750	Way Forward on HARQ feedback for eMBB	MediaTek	Patrick Merias	52292	discussion		Decision
R1-1610751	Way Forward on Symbol Index indication in NR-SS	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610752	Way forward on NR DCI monitoring	Intel, CATT, Ericsson, Panasonic, ETRI	Patrick Merias	52292	discussion		Decision
R1-1610753	Way Forward on congestion control	Huawei, HiSilicon, Ericsson, OPPO, Nokia	Patrick Merias	52292	discussion		Decision
R1-1610754	Way Forward on Definition of Gray Mapped Composite Constellation	ZTE, ZTE Microelectronics, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610755	Correction of PRACH starting subframes for eMTC	Intel Corporation	Patrick Merias	52292	draftCR		Discussion
R1-1610756	Correction of NPRACH frequency hopping	Intel Corporation	Patrick Merias	52292	draftCR		Discussion
R1-1610757	Observations on hardware implementations of flexible channel decoders	AccelerComm	Patrick Merias	52292	discussion		
R1-1610758	Overhead Comparison Between Class-A-Based and Unrestricted Orthogonal Designs	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610759	Way Forward on Remaining Issues on Hybrid CSI	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610760	Clarification on NR HARQ UL/DL timing relationships	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610761	Way Forward on number of ports supported in advanced CSI	Huawei, HiSilicon, MediaTek, ZTE, ZTE Microelectronics, Nokia, ASB, Deutsche Telekom, Samsung, Intel, CATT, Xinwei, InterDigital, Oppo, AT&T, China Unicom, ITRI	Patrick Merias	52292	discussion		Decision
R1-1610762	Way Forward on further details in Advanced CSI	Huawei	Patrick Merias	52292	discussion		Decision
R1-1610763	Way Forward on NZP CSI-RS based interference measurement	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610764	Way Forward on extra scheme supported in hybrid CSI	Huawei	Patrick Merias	52292	discussion		Decision

R1-1610765	LS on RAN2 agreements on FeMBMS	RAN2, Ericsson	Patrick Merias	52292	LS in		
R1-1610766	LS to RAN1 on V2V agreements	RAN2, LGE	Patrick Merias	52292	LS in		
R1-1610767	Way forward on eMBB data channel coding	Samsung, Qualcomm Incorporated, Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless, KT Corporation, KDDI, ETRI, IITH, IITM, CEWiT, Reliance Jio, Tejas Network, Xilinx, Sony, SK Telecom, Intel Corporation, Sharp, MTI, National Instrument, Motorola Mobility, Lenovo, Cohere Technologies, Acorn Technologies, CableLabs, WILUS Inc, NextNav, ASUSTEK, ITL	Patrick Merias	52292	discussion		Decision
R1-1610768	Way Forward on dynamic TDD opreration for NR	ZTE	Patrick Merias	52292	discussion		Decision
R1-1610769	Way Forward on resource reselection	Samsung, CATT, Huawei, HiSilicon, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610770	Way Forward on Clarification of NPRACH for single/multi-tone MSG 3	MediaTek	Patrick Merias	52292	discussion		Decision
R1-1610771	Way Forward on interference measurement enhancement	CATT, Samsung, CATR, ITRI, InterDigital, KT, KDDI, LG Electronics, ZTE, Xinwei	Patrick Merias	52292	discussion		Decision

R1-1610772	Way Forward for Quantized Advanced CSI Feedback Structure	Ericsson, Huawei, HiSilicon, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610773	Correction on CSI measurement in LAA	LG Electronics	Patrick Merias	52292	draftCR		Discussion
R1-1610774	Correction on periodic CSI transmission	LG Electronics	Patrick Merias	52292	draftCR		Discussion
R1-1610775	Correction on UL burst scheduling	LG Electronics	Patrick Merias	52292	draftCR		Discussion
R1-1610776	Way Forward on reliable sidelink SPS	NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610777	Way Forward on NR modulation for high spectral efficency	Samsung, Qualcomm, Intel, IITH, Tejas Networks, IITM, CeWiT, Reliance Jio, KDDI	Patrick Merias	52292	discussion		Decision
R1-1610778	Correction on MPDCCH transmission without repetition	Huawei, HiSilicon	Patrick Merias	52292	CR		Decision
R1-1610779	Discussion on DL control channels	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610780	LS on power allocation for SC-PTM	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1610781	Performance of Advanced CSI with 4 and 8 TX antennas	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610782	Way Forward on enhancement of CS/CB with FD-MIMO	Huawei, HiSilicon, Intel, SoftBank Corp, ZTE, ZTE Microelectronics, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610783	Way Forward on RACH Procedure for Multi-beam without gNB reciprocity	ZTE, ZTE Microelectronics, Nokia, NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610784	Way Forward on DL control channel design	Huawei, HiSilicon, Qualcomm, ZTE, InterDigital, Convida Wireless	Patrick Merias	52292	discussion		Decision

R1-1610785	Way Forward on rate matching for aperiodic CSI-RS	ZTE, ZTE Microelectronics, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610786	Way Forward on hybrid CSI mechanism	ZTE, ZTE Microelectronics, NTT DOCOMO, Ericsson, Intel	Patrick Merias	52292	discussion		Decision
R1-1610787	Way Forward on transmission modes for sTTI	Huawei, HiSilicon, CMCC, Softbank, Qualcomm, Intel, CATT	Patrick Merias	52292	discussion		Decision
R1-1610788	Way Forward on supporting multiplxing sDCI with different AL in one sPDCCH	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610789	Way Forward on Using Scaled Numerology for DL Control	Qualcomm, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610790	Way Forward on Multiplexing eMBB and URLLC in DL	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610791	Way Forward on Fractional RB usage	Samsung, ZTE, ZTE Microelectronics, Panasonic, KDDI, IITH, IITM, Tejas Networks, CEWiT, Nokia	Patrick Merias	52292	discussion		Decision
R1-1610792	Way Forward on coexistence between NR and LTE	LGE	Patrick Merias	52292	discussion		Decision
R1-1610793	Way Forward on SLS observations of non-orthogonal MA	Huawei, HiSilicon, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610794	Way Forward on UL grant-free technical aspects	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610795	Way Forward on non-orthogonal multiple access for non-mMTC scenarios	Huawei, HiSilicon, CATT, Convida Wireless, Interdigital	Patrick Merias	52292	discussion		Decision
R1-1610796	Correction on equation for MPDCCH search space and starting subframe position	NTT DOCOMO, INC., Panasonic	Patrick Merias	52292	CR		Decision
R1-1610797	Correction on equation for MPDCCH search space and starting subframe position	NTT DOCOMO, INC., Panasonic	Patrick Merias	52292	CR		Decision
R1-1610798	LS on DFN offset	RAN2, Huawei	Patrick Merias	52292	LS in		Decision

R1-1610799	Way Forward on Modulation for NR	InterDigital, Qualcomm, Mediatek, Sony, Orange, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610800	Way Forward on coexistence between NR and LTE	LG Electronics, AT&T, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610801	Way Forward on Categorization of MA Signature	ZTE, ZTE Microelectronics, Huawei, HiSilicon, ETRI	Patrick Merias	52292	discussion		Decision
R1-1610802	Discussion on power ratios for MUST Case 1&2	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610803	Way Forward on downlink power allocation for MUST Case 1&2	Huawei, HiSilicon, NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610804	Way Forward on power ratios for MUST Case 1&2	Huawei, HiSilicon, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610805	Way Forward on Gray Conversion for MUST Case 1&2	Huawei, HiSilicon, ZTE, ZTE Microelctronics	Patrick Merias	52292	discussion		Decision
R1-1610806	Way Forward on CRS-based MUST Case 3	Huawei, HiSilicon, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610807	Clarification on IF-HARQ for PC-Polar	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610808	Way Forward on NR UL control channel	Samsung, Qualcomm, Intel, Panasonic, InterDigital, Sony, Ericsson, NTT DOCOMO, Fujitsu, OPPO, CATT, CMCC Samsung, Qualcomm, Intel, Panasonic, InterDigital, Sony, Ericsson, NTT DOCOMO, Fujitsu, OPPO, CATT, CMCC	Patrick Merias	52292	discussion		Decision
R1-1610809	Way Forward on MUST UE multiplexing	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1610810	Way Forward on CP	Huawei, HiSilicon, Sony, OPPO, CATT, Vodafone, Ericsson, ZTE, Intel , Mediatek, NTT DOCOMO, CATR	Patrick Merias	52292	discussion		Decision
R1-1610811	Way Forward on NR DL Control Channel Structure	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610812	Way Forward on DCI design for V2X UL SPS	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610813	Way Forward on DCI design for SL SPS	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610814	DMRS-based sPDCCH	ZTE	Patrick Merias	52292	discussion		Decision
R1-1610815	Way Forward on aperiodic CSI-RS selection	Ericsson, NTT DoCoMo	Patrick Merias	52292	discussion		Decision
R1-1610816	On PHICH collision analysis	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610817	Way Forward on TBS indication for 1.4MHz feMTC UEs	Huawei, HiSilicon, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610818	Way Forward on PHY abstraction method for MA SLS	ZTE, ZTE Microelectronics, Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610819	Way Forward on potential enhancements for Non Coherent Joint Transmission	ZTE, ZTE Microelectronics, Intel, ASTRI, Huawei, HiSilicon, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610820	Way Forward on FeMTC multicast scheduling	Ericsson, ITL, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610821	Observations on hardware implementations of flexible LDPC decoders	AccelerComm	Patrick Merias	52292	discussion		Decision
R1-1610822	Observations on hardware implementations of flexible polar decoders	AccelerComm	Patrick Merias	52292	discussion		Decision
R1-1610823	Way Forward on Network Assistance for NR Uplink Waveform	AT&T, Huawei	Patrick Merias	52292	discussion		Decision
R1-1610824	Way Forward on bundle size and bundle number in HD-FDD for MTC	ZTE, ZTE Microelectronics, Sierra Wireless, Ericsson, Lenovo, Sony	Patrick Merias	52292	discussion		Decision
R1-1610825	Way Forward on Beam management	CATT, CATR, CMCC, Xinwei	Patrick Merias	52292	discussion		Decision

R1-1610826	Way Forward on summary of grant-free progress	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610827	Way Forward on DL sTTI pattern	Huawei, HiSilicon, NTT DOCOMO, Intel, Qualcomm, Ericsson, LGE, Sharp	Patrick Merias	52292	discussion		Decision
R1-1610828	Way Forward on DL measurement for L3 mobility	LG Electronics, Samsung, NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610829	Way Forward on evaluation assumptions for tracking of phase rotation and/or frequency offset	LG Electronics, Nokia, Huawei, Samsung, Qualcomm, InterDigital, KT	Patrick Merias	52292	discussion		Decision
R1-1610830	Way Forward on MUST control operation	Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610831	Way Forward on Spatial Multiplexing Schemes for MU-MIMO	Mitsubishi Electric, InterDigital, Samsung, NTT DOCOMO, IITH, IITM, Tejas Networks, CEWIT, KDDI	Patrick Merias	52292	discussion		Decision
R1-1610832	Way Forward on asynchronous UL HARQ in 1ms TTI	LG Electronics, NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610833	Way Forward on UL short TTI structure	LG Electronics, Huawei, HiSilicon, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, NTT DOCOMO, Sharp, Intel, Qualcomm, CATT	Patrick Merias	52292	discussion		Decision
R1-1610834	Way Forward on UL short TTI structure for 4-symbol sTTI	LG Electronics, Samsung, Ericsson, CATT, NTT DOCOMO, ZTE, ZTE Microelectronics, Huawei, HiSilicon, Panasonic, Sharp	Patrick Merias	52292	discussion		Decision

R1-1610835	Way Forward on sTTI scheduling options	Ericsson, Panasonic, Samsung, Nokia, ASB, ZTE, ZTE Microelectronics, CATT, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610836	Way Forward on handling of PDSCH/sPDSCH assignments for the same subframe and carrier	Ericsson, Huawei, HiSilicon, Qualcomm, NTT DOCOMO, LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610837	CR for clarification on A-CSI without hopping	Qualcomm Incorporated, Samsung	Patrick Merias	52292	CR		Decision
R1-1610838	CR for clarification on A-CSI without hopping	Qualcomm Incorporated, Samsung	Patrick Merias	52292	CR		Decision
R1-1610839	Way Forward on Updated Link Level Evaluation Assumptions for Initial Access in NR	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610840	Way Forward on Multiplexing of SYNC and Broadcast Signals	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610841	[Draft] Reply LS on CSI measurement ambiguity in LAA	LG Electronics	Patrick Merias	52292	LS out		Decision
R1-1610842	Implementation considerations on flexible and efficient LDPC decoders	MediaTek Inc.	Patrick Merias	52292	discussion		
R1-1610843	Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects	NTT DOCOMO, INC.	Patrick Merias	52292	draft TR		Decision
R1-1610844	Offline discussion summary of initial access for NR	NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1610845	Way Forward on NR UL-based RRM measurement	Huawei, HiSilicon, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610846	Way Forward on NR RACH procedure	Huawei, HiSilicon, Qualcomm, ETRI	Patrick Merias	52292	discussion		Decision
R1-1610847	[Draft] LS response on DFN offset	Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610848	TR 38.802 v0.3.0 Study on New Radio (NR) Access Technology - Physical Layer Aspects	NTT DOCOMO, INC.	Patrick Merias	52292	draft TR		Decision
R1-1610849	Way Forward on the definition of beam reciporcity	Samsung	Patrick Merias	52292	discussion		Decision

R1-1610850	Way Forward on Channel Coding	Huawei, HiSilicon, Acer, Bell, CATR, China Unicom, China Telecom, CHTTL, Coolpad, Deutsche Telekom, Etisalat, InterDigital, III, ITRI, MediaTek, Nubia Technology, Nuel, OPPO, Potevio, Spreadtrum, TD Tech, Telus, Vivo, Xiaomi, Xinwei, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610851	Reply LS on CSI measurement ambiguity in LAA	RAN1, LGE	Patrick Merias	52292	discussion		Decision
R1-1610852	Correction on PDCCH candidate configuration	LG Electronics	Patrick Merias	52292	draftCR		Decision
R1-1610853	Correction on PDCCH candidate configuration	LG Electronics	Patrick Merias	52292	draftCR		Decision
R1-1610854	Way Forward on NR RACH procedure	Huawei, HiSilicon, Qualcomm, ETRI	Patrick Merias	52292	discussion		Decision
R1-1610855	Way Forward on the combination of sTTI length for DL and UL	Samsung, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610856	Way Forward on sTTI length for DL	Samsung Ericsson Sharp NTT DOCOMO ;Huawei HiSilicon Intel CATT ;ZTE ZTE Microelectronics LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610857	Observations on Performance and Implementation Issues of AdjMS decoders	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610858	Draft CR on using 25us LBT for UEs on carriers without eNB Cat 4 LBT foe eLAA	Qualcomm	Patrick Merias	52292	draftCR		Discussion
R1-1610859	Draft CR on clarification of PUSCH start position for eLAA	Panasonic, Qualcomm Incorporated	Patrick Merias	52292	draftCR		Decision

R1-1610860	Way Forward on Basics of LDPC Design	Ericsson, Intel, Qualcomm, MediaTek	Patrick Merias	52292	discussion		Decision
R1-1610861	Way Forward on TBS indication for 1.4MHz feMTC UEs	Huawei, HiSilicon, Nokia, Qualcomm, Sierra Wireless	Patrick Merias	52292	discussion		Decision
R1-1610862	void	ETSI	Patrick Merias	52292	other		
R1-1610863	void	ETSI	Patrick Merias	52292	other		
R1-1610864	Chairman's notes of AI 7.2.1 on LTE-based V2X Services	Ad-Hoc chair (LGE)	Patrick Merias	52292	discussion		Endorsement
R1-1610865	Chairman's notes of AI 7.2.2 on Enhancements on Full-Dimension (FD) MIMO for LTE	Ad-Hoc chair (Nokia)	Patrick Merias	52292	discussion		Endorsement
R1-1610866	Chairman's notes of AI 7.2.3 on Downlink Multiuser Superposition Transmission for LTE	Ad-Hoc chair (Qualcomm, MediaTek)	Patrick Merias	52292	discussion		Endorsement
R1-1610867	Chairman's notes of AI 7.2.4 on eMBMS enhancements for LTE	Ad-Hoc chair (Nokia, Ericsson)	Patrick Merias	52292	discussion		Endorsement
R1-1610868	Chairman's notes of AI 7.2.5 on SRS Carrier Based Switching for LTE	Ad-Hoc chair (Huawei)	Patrick Merias	52292	discussion		Endorsement
R1-1610869	Chairman's notes of AI 7.2.6 on Further Indoor Positioning enhancements for UTRA and LTE	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement
R1-1610870	Chairman's notes of AI 7.2.7 on Uplink Capacity Enhancements for LTE	Ad-Hoc chair (Ericsson)	Patrick Merias	52292	discussion		Endorsement
R1-1610871	Chairman's notes of AI 7.2.8 on Further Enhanced MTC for LTE	Ad-Hoc chair (Nokia, Ericsson)	Patrick Merias	52292	discussion		Endorsement
R1-1610872	Chairman's notes of AI 7.2.9 on Enhancements of NB-IoT	Ad-Hoc chair (Huawei)	Patrick Merias	52292	discussion		Endorsement
R1-1610873	Chairman's notes of AI 7.2.10 on Shortened TTI and processing time for LTE	Ad-Hoc chair (Ericsson)	Patrick Merias	52292	discussion		Endorsement
R1-1610874	Chairman's notes of AI 7.2.11 on Performance enhancements for high speed scenario	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement
R1-1610875	Chairman's notes of AI 7.2.12 on Study on Enhancement of VoLTE	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement
R1-1610876	Chairman's notes of AI 7.2.13 on Study on Further enhancements to Coordinated Multi-Point Operation	Ad-Hoc chair (Intel)	Patrick Merias	52292	discussion		Endorsement
R1-1610877	Chairman's notes of AI 8.1.1 on waveform and multiple access schemes for NR	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement

R1-1610878	Chairman's notes of AI 8.1.3 on channel coding and modulation for NR	Ad-Hoc chair (Nokia)	Patrick Merias	52292	discussion		Endorsement
R1-1610879	Chairman's notes of AI 8.1.6 on duplexing for NR	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement
R1-1610880	Chairman's notes of AI 8.1.8	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement
R1-1610881	Chairman's notes of AI 8.2	Ad-Hoc chair (Nokia)	Patrick Merias	52292	discussion		Endorsement
R1-1610882	Chairman's notes of AI 7.1 on CRs	Ad-Hoc chair (Qualcomm)	Patrick Merias	52292	discussion		Endorsement
R1-1610883	Way Forward on Using Scaled Numerology for Control Transmission	Qualcomm, ZTE, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610884	Removal of LAA DRS channel access from UL Type 2 Channel Access description	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	CR		Decision
R1-1610885	Observations on Area	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610886	Clarification of PUSCH start position for eLAA	Panasonic, Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1610887	Notes from offline discussion on ulplink control channels	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610888	Way Forward on NR MIMO calibration	ZTE, ZTE Microelectronics, Nokia, ASB, CATT, MediaTek, Xinwei, Huawei, Hisilicon, Intel, Ericsson, Mitsubishi Electric, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610889	Way Forward on Phase 1 link-level calibration for NR-MIMO with simplified antenna configuration	ZTE, ZTE Microelectronics, CATT, MediaTek, Xinwei, Huawei, Hisilicon, Intel, Ericsson, Nokia, ASB, Mitsubishi Electric, NTT DOCOMO, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610890	Clarification on assumptions for Phase 1 link-level calibration for NR-MIMO	ZTE	Patrick Merias	52292	discussion		Decision

R1-1610891	Way Forward on group-based beam management	ZTE, ZTE Microelectronics, ASTRI, Nokia, ASB, CATT	Patrick Merias	52292	discussion		Decision
R1-1610892	Way Forward on reference signal for demodulation	ZTE	Patrick Merias	52292	discussion		Decision
R1-1610893	Way Forward on MIMO transmission based on multiple antenna panels	Huawei, HiSilicon, Xinwei, NEC	Patrick Merias	52292	discussion		Decision
R1-1610894	Way Forward on UL beam management	Samsung, Huawei, Intel	Patrick Merias	52292	discussion		Decision
R1-1610895	Way Forward on DL MIMO transmission	Huawei, HiSilicon, CATT	Patrick Merias	52292	discussion		Decision
R1-1610896	CR on UL duration and offset field in TS 36.213	ETRI	Patrick Merias	52292	CR		Decision
R1-1610897	Observations on Area	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610898	Way Forward on coordinated transmission in NR	LG Electronics, Huawei, HiSilicon, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610899	Way Forward on CSI feedback framework for hybrid beamforming in NR	CMCC, CATT, Xinwei, Samsung, Ericsson, Huawei, HiSilicon, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610900	Correction on channel access priority class according to UL LBT type indication in eLAA	WILUS Inc.	Patrick Merias	52292	CR		Decision
R1-1610901	Correction on downlink power allocation for SC-PTM	TD Tech, Huawei	Patrick Merias	52292	CR		Decision
R1-1610902	Way Forward on Multiplexing eMBB and URLLC in DL	Samsung, Panasonic, ZTE, ZTE Microelectronics, ETRI, Ericsson, CATT, Huawei, NTT DOCOMO, LGE, CMCC, Convida wireless, InterDigital, Sony, Fujitsu	Patrick Merias	52292	discussion		Decision
R1-1610903	Way Forward on Performance enhancements for high speed scenario	Huawei, HiSilicon, Nokia, ASB, NTT DOCOMO	Patrick Merias	52292	discussion		Decision

R1-1610904	Way Forward on Low PAPR Modulation in NR	Samsung, Qualcomm, Intel, Vodafone, AT&T, MediaTek, KDDI, InterDigital, IITH, IITM, Tejas Networks, Reliance-Jio, CEWiT, National Instruments	Patrick Merias	52292	discussion		Decision
R1-1610905	Way Forward on UTDOA for NB-IoT	ZTE , ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610906	Way Forward on channel and interference measurements for NR	Samsung, Intel, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610907	Way Forward on CSI-RS resource pooling	Ericsson, Samsung, LG, Nokia	Patrick Merias	52292	discussion		Decision
R1-1610908	Correction on periodic CSI transmission	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1610909	Way Forward on Multipath RSTD	Ericsson, Nokia, Qualcomm, Acorn Technology	Patrick Merias	52292	discussion		Decision
R1-1610910	Draft LS on Multipath RSTD report	Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610911	Clarification on i_0 value	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1610912	Clarification on i_0 value	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1610913	Way Forward on enhancement in step 2 for supporting shorter periodicity	LG Electronics, CATT	Patrick Merias	52292	discussion		Decision
R1-1610914	Correction of PRACH starting subframes for eMTC	Intel Corporation	Patrick Merias	52292	CR		Decision
R1-1610915	Correction of PRACH starting subframes for eMTC	Intel Corporation	Patrick Merias	52292	CR		Decision
R1-1610916	Correction of NPRACH frequency hopping	Intel Corporation	Patrick Merias	52292	CR		Decision

R1-1610917	Correction of NPRACH frequency hopping	Intel Corporation	Patrick Merias	52292	CR		Decision
R1-1610918	Link-level evaluation results of UL NOMA schemes	Intel Corporation	Patrick Merias	52292	discussion		Decision
R1-1610919	Way Forward on PUCCH and SRS not belonging to any narrowband for BL/CE UE	Ericsson, Alcatel-Lucent Shanghai Bell, Intel, Nokia, NTT DoCoMo, Qualcomm, Sequans, Sony, Sierra Wireless, Virtuosys, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610920	[Draft] LS response on Exceptional Pool Handling for V2X	Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610921	Way Forward on VoLTE and ViLTE enhancement	Huawei, HiSilicon, China Telecommunications	Patrick Merias	52292	discussion		Decision
R1-1610922	Way Forward on FeMTC eVoLTE	Huawei, HiSilicon, Ericsson, Qualcomm, Sequans	Patrick Merias	52292	discussion		Decision
R1-1610923	Way Forward on Beam reporting for NR	LG Electronics, Intel, NTT DOCOMO, MediaTek	Patrick Merias	52292	discussion		Decision
R1-1610924	Way Forward on remaining details on PDSCH rate matching	LG Electronics, InterDigital, Qualcomm, ZTE, ZTE Microelectronics	Patrick Merias	52292	discussion		Decision
R1-1610925	Way Forward on dynamic resource sharing between eMBB and URLLC in DL	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610926	Correction on MPDCCH transmission without repetition	Huawei, HiSilicon	Patrick Merias	52292	CR		Decision
R1-1610927	Way Forward on eMBMS enhancements	Ericsson, Qualcomm, Intel, Nokia, ASB, BBC, IRT, EBU	Patrick Merias	52292	discussion		Decision

R1-1610928	Way Forward on PRS-Based RSRP/RSRQ Measurement and Reporting for PRS-Based Beacon	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	discussion		Decision
R1-1610929	LS response on DFN offset	RAN1, Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610930	LS response on Exceptional Pool Handling for V2X	RAN1, Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610931	WF on channel coding observations for short block size	IMT, Orange, AccelerComm, Ericsson, LG, NEC	Patrick Merias	52292	discussion		Decision
R1-1610932	Way Forward on supporting 50 ms periodicity	CATT	Patrick Merias	52292	discussion		Decision
R1-1610933	Way Forward on longer CP	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610934	Way Forward on OTDOA for eMTC	ZTE, ZTE Microelectronics, Ericsson, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610935	Outcome offline discussion on V2V maintenance	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610936	Outcome offline discussion on V2X	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610937	Way Forward on CSI parameters for NR	Samsung, Nokia, ASB, AT&T, CATT, NTT DOCOMO, Ericsson, Intel, LG Electronics, InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610938	Outcome of Friday Offline Session on eFD-MIMO	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610939	Phase 1 link level calibration results for NR MIMO	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610940	Codebook design for up to 32 CSI-RS ports	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610941	Way Forward on MAC CE based activation/release mechanism	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610942	Way Forward on Class A codebook enhancements	Qualcomm, LG Electronics, Xinwei	Patrick Merias	52292	discussion		Decision

R1-1610943	Offline outcome of Wednesday evening on 8.1.7.1	NTT DOCOMO	Patrick Merias	52292	discussion		
R1-1610944	CR for clarification on A-CSI without hopping	Qualcomm Incorporated, Samsung	Patrick Merias	52292	CR		Decision
R1-1610945	CR for clarification on A-CSI without hopping	Qualcomm Incorporated, Samsung	Patrick Merias	52292	CR		Decision
R1-1610946	Way Forward on URLLC HARQ	Intel	Patrick Merias	52292	discussion		Decision
R1-1610947	Way Forward on MUST control operation	Nokia, Alcatel-Lucent Shanghai Bell, NEC	Patrick Merias	52292	discussion		Decision
R1-1610948	Way Forward on power ratios for Case 1 and 2	Huawei, HiSilicon, Qualcomm, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1610949	Way Forward on forward compatibility for NR	Samsung, LG Electronics, Nokia, ASB, Ericsson, Huawei, HiSilicon, Qualcomm, AT&T, Panasonic	Patrick Merias	52292	discussion		Decision
R1-1610950	WF on interference measurement for CSI acquisition	Qualcomm, Huawei, HiSilicon, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610951	Way Forward on LLS evaluation assumption for control channel evaluation in URLLC	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610952	Way Forward on Semi-static resource sharing between URLLC and eMBB	LG Electronics, Panasonic	Patrick Merias	52292	discussion		Decision
R1-1610953	Way Forward on carrier aggregation	Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO, Qualcomm, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610954	WF on synchronization and carrier rasters	Huawei, HiSilicon, Ericsson, NTT Docomo, Fujitsu	Patrick Merias	52292	discussion		Decision
R1-1610955	WF on channel model for Rural macro scenario	Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610956	WF on Common Features and General Framework of MA Schemes	Huawei, HiSilicon, CATR, CATT, CMCC, Samsung, ETRI, MediaTek	Patrick Merias	52292	discussion		Decision

R1-1610957	WF on Further Summary of LLS Results	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610958	WF on Grant-free URRLC Performance Evaluations	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1610959	WF on Updated Link Level Evaluation Assumptions for Initial Access in NR	Qualcomm, NTT DOCOMO, Samsung, Intel	Patrick Merias	52292	discussion		Decision
R1-1610960	Way Forward on RACH preamble	NTT DOCOMO, Intel, Sharp, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610961	Way Forward on O2I model for rural scenario	Huawei, HiSilicon, CATT, CATR, CMCC	Patrick Merias	52292	discussion		Decision
R1-1610962	Way Forward on Unified RACH Procedure	ZTE, ZTE Microelectronics, NTT DOCOMO, Nokia, Alcatel-Lucent Shanghai Bell, Sharp, Intel	Patrick Merias	52292	discussion		Decision
R1-1610963	Way Forward on Group-based beam management	ZTE	Patrick Merias	52292	discussion		Decision
R1-1610964	WF on Beam Recovery	Samsung, Qualcomm, Intel, KT, LGE, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1610965	WF on SLS/LLS results summary	LG Electronics	Patrick Merias	52292	discussion		Decision
R1-1610966	Draft LS on V2X UE transmission chain	Huawei	Patrick Merias	52292	LS out		Decision
R1-1610967	WF on MIMO transmisison techniques in NR	LG Electronics, Qualcomm, KT	Patrick Merias	52292	discussion		Decision
R1-1610968	Way Forward on search space of NB-IoT SC-PTM	Huawei, HiSilicon, ZTE	Patrick Merias	52292	discussion		Decision
R1-1610969	Draft LS on SC-MCCH transmission in NB-IoT	HiSilicon	Patrick Merias	52292	LS out		Decision
R1-1610970	Draft LS on collisions between SC-PTM and Paging in NB-IoT	HiSilicon	Patrick Merias	52292	LS out		Decision
R1-1610971	Way Forward on the definition of beam reciporcity	Samsung, Qualcomm, InterDigital, Intel, IITM, IITH, CeWIT, Tejas Networks, KT, MediaTek, AT&T, Verizon, Motorola Mobility, Reliance Jio	Patrick Merias	52292	discussion		Decision

R1-1610972	[DRAFT] LS on Multipath RSTD reporting and CRS usage together with PRS	Ericsson, Intel	Patrick Merias	52292	LS out		Decision
R1-1610973	WF on prioritizing V2X SL TX over WAN TX	NTT DOCOMO, LGE, ZTE, NOKIA, Alcatel-Lucent Shanghai Bell, CATT, Samsung, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610974	Outcomes of Thursday offline session on NR MIMO	Samsung	Patrick Merias	52292	discussion		Decision
R1-1610975	WF on DL measurement for L3 mobility	Samsung, LG Electronics, NTT DOCOMO, AT&T, Ericsson, Intel	Patrick Merias	52292	discussion		Decision
R1-1610976	WF on Updated Link Level Evaluation Assumptions for RACH Preamble	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610977	WF on V2V support for TDD	Intel, CATT	Patrick Merias	52292	discussion		Decision
R1-1610978	Way Forward on NR RACH procedure	Huawei, HiSilicon, NTT Docomo, Qualcomm, ETRI, Intel, Nokia	Patrick Merias	52292	discussion		Decision
R1-1610979	[DRAFT] LS on NR RACH procedure	Huawei	Patrick Merias	52292	LS out		Decision
R1-1610980	Way Forward on Beam management	CATT	Patrick Merias	52292	discussion		Decision
R1-1610981	Way forward on observations of eMBB data channel coding for short block length	InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610982	WF on NR channel coding selection	CMCC	Patrick Merias	52292	discussion		Decision
R1-1610983	WF on SRS-based UL link adaptation	LG Electronics, CATT, Huawei, HiSilicon, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610984	Way Forward on Basics of LDPC Design	Ericsson, Intel, Qualcomm, NTU, Nokia, ASB, LG, Samsung	Patrick Merias	52292	discussion		Decision
R1-1610985	[DRAFT] Reply LS on A New PRACH Cyclic Shift Restriction Set	Huawei	Patrick Merias	52292	LS out		Decision
R1-1610986	WF on Updated Link Level Evaluation Assumptions for RACH Preamble	Qualcomm	Patrick Merias	52292	discussion		Decision

R1-1610987	WF on Updated Link Level Evaluation Assumptions for Initial Access in NR	Qualcomm, NTT DOCOMO, Samsung, Intel	Patrick Merias	52292	discussion		Decision
R1-1610988	[Draft] LS on supported modulations for Sidelink V2X	Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610989	LS on supported modulations for Sidelink V2X	RAN1, Ericsson	Patrick Merias	52292	LS out		Decision
R1-1610990	[Draft] LS on NR RACH Procedure	Huawei	Patrick Merias	52292	LS out		Decision
R1-1610991	WF on Updated System Level Evaluation Assumptions for Initial Access in NR	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1610992	LS on NR RACH Procedure	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1610993	Way forward on observations of eMBB data channel coding for large block length	InterDigital	Patrick Merias	52292	discussion		Decision
R1-1610994	Way Forward on timing relationships of 2 HARQ processes for NB-IoT enhancement	Huawei, HiSilicon, Deutsche Telekom, Vodafone, China Unicom, IITH, CEWIT, IITM, Tejas Networks, Reliance Jio, Ericsson, ITL, Lenovo, Neul, Potevio, u-blox, Sony	Patrick Merias	52292	discussion		Decision
R1-1610995	Way Forward on dynamic resource sharing between eMBB and URLLC in DL	Huawei, HiSilicon, CATR,Potevio,Samsung	Patrick Merias	52292	discussion		Decision
R1-1610996	Draft CR on UL CWS adjustment for eLAA in 36.213	Huawei, HiSilicon, Qualcomm, Broadcom, LGE, Ericsson, Intel	Patrick Merias	52292	draftCR		Discussion
R1-1610997	WF on Channel Coding Design for NR	Ericsson, LG	Patrick Merias	52292	discussion		Decision
R1-1610998	CR for RI transmission on PUSCH for LAA Scells	Qualcomm	Patrick Merias	52292	CR		Decision
R1-1610999	WF on UL Power Control	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1611000	LS on V2X UE transmission chain	RAN1, Huawei	Patrick Merias	52292	LS out		Decision

R1-1611001	void	ETSI	Patrick Merias	52292	other		
R1-1611002	void	ETSI	Patrick Merias	52292	other		
R1-1611003	void	ETSI	Patrick Merias	52292	other		
R1-1611004	void	ETSI	Patrick Merias	52292	other		
R1-1611005	Way Forward on UCI transmission for NR	LG Electronics, Intel, Panasonic	Patrick Merias	52292	discussion		Decision
R1-1611006	Draft LS on configuration of NPRS power for NB-IoT downlink positioning	Huawei	Patrick Merias	52292	LS out		Decision
R1-1611007	Correction on periodic CSI transmission	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1611008	System-level analysis of UL NOMA schemes	Intel Corporation	Patrick Merias	52292	discussion		
R1-1611009	Draft LS for SRS Carrier-Based Switching Agreements	Huawei	Patrick Merias	52292	LS out		Decision
R1-1611010	Evaluation Assumptions for NR Network Coordination	Samsung, Intel, ZTE, ZTE Microelectronics, Huawei	Patrick Merias	52292	discussion		Decision
R1-1611011	WF on RACH preamble evaluation assumptions	Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1611012	Way Forward on evaluation assumptions for tracking of phase rotation and/or frequency offset	LG Electronics, Nokia, Huawei, Samsung, Qualcomm, InterDigital, KT, ZTE	Patrick Merias	52292	discussion		Decision
R1-1611013	Way Forward on Remaining Issues on Hybrid CSI	Samsung, Ericsson	Patrick Merias	52292	discussion		Decision
R1-1611014	Way Forward on Beam management	CATT, CATR, CMCC, Xinwei, Samsung	Patrick Merias	52292	discussion		Decision
R1-1611015	WF on Assumptions for Comparing Different SYNC Multiplexing Techniques	Qualcomm	Patrick Merias	52292	discussion		Decision

R1-1611016	Way Forward on P-UE sensing timeline in partial sensing	Huawei, HiSilicon, Sequans, ZTE, Sony	Patrick Merias	52292	discussion		Decision
R1-1611017	[DRAFT]LS on FeMTC VoLTE enhancements	Huawei	Patrick Merias	52292	LS out		Decision
R1-1611018	Way Forward for Quantized Advanced CSI Feedback Structure	Ericsson, Huawei, HiSilicon, ZTE, ZTE Microelectronics, CATT, Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1611019	WF on timing relationship for 2 HARQ processes for Rel-14 NB-IoT	MediaTek, Qualcomm, DoCoMo, AT&T, Softbank, ITRI, Sharp, MTI, APT, Xinwei, ZTE, ZTE Microelectronics, KDDI	Patrick Merias	52292	discussion		Decision
R1-1611020	Correction of typos due to wrong implementation of CR0283 “Clarification of valid subframe in eMTC”	MCC, Qualcomm	Patrick Merias	52292	CR		Decision
R1-1611021	Draft CR on trigger monitoring timeline for triggered grants in eLAA	Qualcomm Incorporated	Patrick Merias	52292	draftCR		Discussion
R1-1611022	Draft CR on UL CWS adjustment for eLAA in 36.213	Huawei, HiSilicon, Qualcomm, Broadcom, LGE, Ericsson, Intel	Patrick Merias	52292	CR		Decision
R1-1611023	Comparison of OFDMA vs LSSA system level UL performance	ETRI	Chanho Yoon	60029	other		
R1-1611024	Offline Thursday discussion summary of initial access for NR	NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1611025	CR on trigger monitoring timeline for triggered grants in eLAA	Qualcomm Incorporated	Patrick Merias	52292	CR		Decision
R1-1611026	Reply LS on CSI measurement ambiguity in LAA	RAN1, LG Electronics	Patrick Merias	52292	LS out		Decision
R1-1611027	Correction on CSI reference resource definition in LAA	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1611028	Correction on CSI reference resource definition in LAA	LG Electronics	Patrick Merias	52292	CR		Decision

R1-1611029	Correction on CSI measurement in LAA	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1611030	Correction on CSI measurement in LAA	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1611031	Response LS to IEEE 802.11 regarding LAA	RAN1, Qualcomm	Patrick Merias	52292	LS out		Decision
R1-1611032	LS on configuration of NPRS power for NB-IoT downlink positioning	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1611033	LS on SC-MCCH transmission in NB-IoT	RAN1, HiSilicon	Patrick Merias	52292	LS out		Decision
R1-1611034	LS on collisions between SC-PTM and Paging in NB-IoT	RAN1, HiSilicon	Patrick Merias	52292	LS out		Decision
R1-1611035	WF on synchronization and carrier rasters	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1611036	WF on DL control channel design	Huawei, HiSilicon, Qualcomm, ZTE	Patrick Merias	52292	discussion		Decision
R1-1611037	Way Forward on phase continuity of DL precodong	Qualcomm, Huawei, HiSilicon, Xinwei, Ericsson, ZTE, ZTE Microelectronics, Intel	Patrick Merias	52292	discussion		Decision
R1-1611038	WF on Updated System Level Evaluation Assumptions for Initial Access in NR	Qualcomm	Patrick Merias	52292	discussion		Decision
R1-1611039	Offline outcome of Thursday afternoon on 8.1.7	NTT DOCOMO	Patrick Merias	52292	discussion		
R1-1611040	Offline outcome of Thursday afternoon on 8.1.2	NTT DOCOMO	Patrick Merias	52292	discussion		
R1-1611041	Way Forward on bandwidth adapatation in NR	MediaTek, Acer, CHTTL, III, Panasonic, Ericsson, Nokia, ASB, Samsung, LG, Intel	Patrick Merias	52292	discussion		Decision
R1-1611042	Draft LS on L1 parameters for Carrier-Based Switching	Huawei	Patrick Merias	52292	LS out		Decision
R1-1611043	Discussion about Mini-slots	ZTE	Patrick Merias	52292	discussion		
R1-1611044	Way Forward on DL MIMO Transmission	Huawei, HiSilicon, Ericsson, CATT	Patrick Merias	52292	discussion		Decision

R1-1611045	Correction on downlink power allocation for SC-PTM	TD Tech, Huawei	Patrick Merias	52292	CR		Decision
R1-1611046	Way Forward on SRS transmission	CATT, Nokia, ASB	Patrick Merias	52292	discussion		Decision
R1-1611047	Way Forward on Network Coordination for Advanced Receivers	Samsung, Intel, MediaTek, Orange, Vodafone, IITH, Tejas Networks, IITM, KDDI, CeWiT, Reliance Jio	Patrick Merias	52292	discussion		Decision
R1-1611048	Summary of RAN1 agreements for Rel-14 FeMTC	Ericsson	Patrick Merias	52292	other		Information
R1-1611049	LS for SRS Carrier-Based Switching Agreements	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1611050	LS on L1 parameters for Carrier-Based Switching	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1611051	LS regarding agreements for FeMBMS	RAN1, Qualcomm	Patrick Merias	52292	LS out		Decision
R1-1611052	LS on Multipath RSTD reporting and CRS usage together with PRS	RAN1, Ericsson, Intel	Patrick Merias	52292	LS out		Decision
R1-1611053	LS on FeMTC VoLTE enhancements	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1611054	LS on implication of sTTI operation on UL ON/OFF time mask	RAN1, Ericsson	Patrick Merias	52292	LS out		Decision
R1-1611055	LS On Shortened TTI and processing time for LTE	RAN1, Ericsson	Patrick Merias	52292	LS out		Decision
R1-1611056	Reply LS on A New PRACH Cyclic Shift Restriction Set	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1611057	LS for Voice and Video enhancement for LTE	RAN1, Huawei	Patrick Merias	52292	LS out		Decision
R1-1611058	WF on further MA results summary	LG Electronics, Huawei, HiSilicon, ZTE, Samsung	Patrick Merias	52292	discussion		Decision
R1-1611059	Way Forward on Data Sharing	Qualcomm	Patrick Merias	52292	discussion		Information
R1-1611060	Offline outcome of Friday morning	NTT DOCOMO	Patrick Merias	52292	discussion		Decision
R1-1611061	[Draft] LS on RAN1 agreements potentially related to RAN2/4 in LTE-based V2X services	LGE	Patrick Merias	52292	LS out		Decision
R1-1611062	Summary of preliminary LLS results	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision

R1-1611063	Summary of preliminary SLS results	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1611064	Way Forward on Network Coordination for Advanced Receivers	Samsung, Intel, MediaTek, AT&T, Orange, Vodafone, IITH, Tejas Networks, IITM, KDDI, CeWiT, Reliance Jio	Patrick Merias	52292	discussion		Decision
R1-1611065	To capture LLS and SLS simulation results for NR MA Huawei, HiSilicon	Huawei, HiSilicon	Patrick Merias	52292	discussion		Decision
R1-1611066	LS on RAN1 agreements potentially related to RAN2/4 in LTE-based V2X services	RAN1, LGE	Patrick Merias	52292	LS out		Decision
R1-1611067	List of agreements for “SRS Carrier-Based Switching”	Huawei	Patrick Merias	52292	other		Information
R1-1611068	Summary of RAN1 agreements for Rel-14 work item on ‘Performance enhancements for high speed scenario’	Huawei, HiSilicon, NTT DOCOMO	Patrick Merias	52292	other		Information
R1-1611069	Summary of RAN1 agreements for Rel-14 Further Indoor Positioning	Huawei, HiSilicon, NextNav	Patrick Merias	52292	other		Information
R1-1611070	Summary of RAN1 Agreements for Rel-14 DL MUST	MediaTek	Patrick Merias	52292	other		Information
R1-1611071	NR channel coding BLER database	InterDigital	Patrick Merias	52292	other		Information
R1-1611072	Correction on PDCCH candidate configuration	LG Electronics	Patrick Merias	52292	CR		Decision
R1-1611073	New Transport Block Size (TBS) tables for Rel-14 NB-IoT	Ericsson	Patrick Merias	52292	other		
R1-1611074	Correction on PDCCH candidate configuration	Nokia, Alcatel-Lucent Shanghai Bell	Patrick Merias	52292	CR		Decision

Abstract	Secretary Remarks	Agenda item sort order	Agenda item #	Agenda item description	TDoc sort order within agenda item	TDoc Status
		2	2	Approval of Agenda	0	revised
		3	3	Approval of Minutes from previous meeting	0	approved
		4	4	Highlights from RAN Plenary	0	noted
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated
		5	5	Incoming Liaison Statements	0	treated

		5	5	Incoming Liaison Statements	0	**treated**
		5	5	Incoming Liaison Statements	0	**treated**
		5	5	Incoming Liaison Statements	0	**treated**
		5	5	Incoming Liaison Statements	0	**treated**
This paper shows that LDPC (and polar) decoders have a fundamental drawback, which results in poor information throughput, latency, hardware efficiency and area efficiency at low and medium coding rates. A comprehensive survey of 100 ASICs is used to show that compared to flexible LDPC decoders, flexible turbo decoders offer very significant improvements in these four hardware characteristics at low and medium coding rates. This motivates the selection of flexible turbo codes for low and medium coding rates and inflexible 20 Gbps LDPC decoders for high coding rates.		126	8.1.3.1	Channel coding	0	**noted**
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	**available**

		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	**noted**
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	**available**
		76	7.2.5.2	DCI design	0	**noted**
		77	7.2.5.3	Details of collision handling	0	**available**
		78	7.2.5.4	Other	0	**available**
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**available**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**noted**
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**available**
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**noted**
		53	7.2.2.1.2	Interference measurement	0	**available**
		54	7.2.2.1.3	Feedback mechanism enhancement	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**noted**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		57	7.2.2.3	UL DMRS	0	**available**
		57	7.2.2.3	UL DMRS	0	**noted**

		64	7.2.3.1	Superposition transmissions	0	revised
		65	7.2.3.2	Mechanisms for efficient operation	0	available
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	noted
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	noted
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	available
		112	7.2.13	Study on Further enhancements to Coordinated Multi-Point Operation - SID in RP-160954	0	available
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	noted
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	noted
		100	7.2.9.2	Multicast support	0	noted
		100	7.2.9.2	Multicast support	0	available
		100	7.2.9.2	Multicast support	0	available
		100	7.2.9.2	Multicast support	0	available
		100	7.2.9.2	Multicast support	0	available
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	noted
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	noted
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	available
		98	7.2.9.1.2	Evaluation of narrowband OTDOA positioning	0	available
		98	7.2.9.1.2	Evaluation of narrowband OTDOA positioning	0	available
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	available
		86	7.2.8.1	Higher data rates	0	available

		86	7.2.8.1	Higher data rates	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	**available**
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**

		108	7.2.10.2.2	Processing time	0	available
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	noted
		102	7.2.9.4	Power consumption and latency reduction	0	noted
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		93	7.2.8.4	VoLTE enhancements	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		38	7.2.1.2.3	Others	0	available
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		128	8.1.4	Multi-antenna scheme for new radio interface	0	available
		133	8.1.4.5	Other	0	noted
		133	8.1.4.5	Other	0	available
		133	8.1.4.5	Other	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	revised

		129	8.1.4.1	Beam management	0	**available**
		129	8.1.4.1	Beam management	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**noted**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		66	7.2.3.3	Evaluation for MUST using up to 8Tx	0	**noted**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		53	7.2.2.1.2	Interference measurement	0	**available**
		54	7.2.2.1.3	Feedback mechanism enhancement	0	**available**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**available**

		57	7.2.2.3	UL DMRS	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		61	7.2.2.5.2	Hybrid CSI	0	available
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	noted
		131	8.1.4.3	CSI acquisition	0	available
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	available
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	available
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	available
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	noted
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	noted
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	revised
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	noted
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	available
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	available
		100	7.2.9.2	Multicast support	0	noted

		101	7.2.9.3	Non-anchor PRB enhancements	0	available
		101	7.2.9.3	Non-anchor PRB enhancements	0	available
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	not pursued
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	revised
		120	8.1.1.1	Waveform	0	withdrawn
		120	8.1.1.1	Waveform	0	noted
		124	8.1.2.2	Frame structure	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	available
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	withdrawn
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	revised
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		29	7.1.9	Other	0	agreed
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	revised
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	available
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	available
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	available
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	available

		52	7.2.2.1.1	Advanced CSI	0	**available**
		53	7.2.2.1.2	Interference measurement	0	**noted**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**available**
		57	7.2.2.3	UL DMRS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		61	7.2.2.5.2	Hybrid CSI	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		78	7.2.5.4	Other	0	**available**
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**

		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		108	7.2.10.2.2	Processing time	0	available
		108	7.2.10.2.2	Processing time	0	revised
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available

		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		133	8.1.4.5	Other	0	withdrawn
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	available
		136	8.1.5.2	RACH procedure	0	available
		137	8.1.5.3	Mobility	0	available

		140	8.1.6.1	Resource assignment and interference handling	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	available
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	available
	Late contribution	93	7.2.8.4	VoLTE enhancements	0	withdrawn
		120	8.1.1.1	Waveform	0	available
		121	8.1.1.2	Multiple access scheme	0	revised
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		130	8.1.4.2	Multi-antenna scheme	0	noted
		129	8.1.4.1	Beam management	0	available
		131	8.1.4.3	CSI acquisition	0	available

		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		133	8.1.4.5	Other	0	available
		132	8.1.4.4	Reference signal design and QCL	0	noted
		134	8.1.5	Aspects related to initial access and mobility	0	available
		136	8.1.5.2	RACH procedure	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	noted
		140	8.1.6.1	Resource assignment and interference handling	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		138	8.1.5.4	Other	0	available
		123	8.1.2.1	Numerology	0	available

		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		147	8.1.8	Other	0	available
		123	8.1.2.1	Numerology	0	available
		147	8.1.8	Other	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		137	8.1.5.3	Mobility	0	available
		137	8.1.5.3	Mobility	0	available
		136	8.1.5.2	RACH procedure	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available

		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	revised
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	noted
		120	8.1.1.1	Waveform	0	available
		121	8.1.1.2	Multiple access scheme	0	noted
		127	8.1.3.2	Modulation	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available

		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	**noted**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**noted**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**noted**
		100	7.2.9.2	Multicast support	0	**available**
		100	7.2.9.2	Multicast support	0	**noted**
		100	7.2.9.2	Multicast support	0	**available**
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		102	7.2.9.4	Power consumption and latency reduction	0	**available**
		102	7.2.9.4	Power consumption and latency reduction	0	**available**
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**

		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		92	7.2.8.3	OTDOA enhancements	0	**noted**
		93	7.2.8.4	VoLTE enhancements	0	**available**
		93	7.2.8.4	VoLTE enhancements	0	**available**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**noted**
		124	8.1.2.2	Frame structure	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**

		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		123	8.1.2.1	Numerology	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		140	8.1.6.1	Resource assignment and interference handling	0	**noted**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**noted**
		57	7.2.2.3	UL DMRS	0	**noted**
		57	7.2.2.3	UL DMRS	0	**available**

		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		61	7.2.2.5.2	Hybrid CSI	0	**available**
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	**noted**
		129	8.1.4.1	Beam management	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		100	7.2.9.2	Multicast support	0	**available**
		124	8.1.2.2	Frame structure	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**

		131	8.1.4.3	CSI acquisition	0	available
		92	7.2.8.3	OTDOA enhancements	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	noted
		124	8.1.2.2	Frame structure	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		147	8.1.8	Other	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	noted
		124	8.1.2.2	Frame structure	0	available
		147	8.1.8	Other	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	noted
		136	8.1.5.2	RACH procedure	0	available
		137	8.1.5.3	Mobility	0	available

		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**revised**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
This paper shows that polar (and LDPC) decoders have a fundamental drawback, which results in poor information throughput, latency, hardware efficiency and area efficiency at low and medium coding rates. A comprehensive survey of 150 hardware implementations is used to evaluate the maturity of polar decoders and show that compared to flexible polar decoders, flexible turbo decoders offer very significant improvements in these four hardware characteristics at low and medium coding rates.		126	8.1.3.1	Channel coding	0	**noted**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**noted**

		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	available
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	available
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	available
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	noted
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	available
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available

		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		108	7.2.10.2.2	Processing time	0	available
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	available
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	noted
		52	7.2.2.1.1	Advanced CSI	0	noted
		52	7.2.2.1.1	Advanced CSI	0	available
		52	7.2.2.1.1	Advanced CSI	0	available
		53	7.2.2.1.2	Interference measurement	0	available
		53	7.2.2.1.2	Interference measurement	0	available
		53	7.2.2.1.2	Interference measurement	0	available

		54	7.2.2.1.3	Feedback mechanism enhancement	0	available
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	available
		56	7.2.2.2	Open-loop and Semi-open-loop	0	noted
		56	7.2.2.2	Open-loop and Semi-open-loop	0	noted
		57	7.2.2.3	UL DMRS	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		61	7.2.2.5.2	Hybrid CSI	0	available
		61	7.2.2.5.2	Hybrid CSI	0	revised
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	available
		76	7.2.5.2	DCI design	0	noted
		77	7.2.5.3	Details of collision handling	0	available
		78	7.2.5.4	Other	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	noted
		120	8.1.1.1	Waveform	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available

		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	withdrawn
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	noted
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	noted
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	withdrawn
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available

		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		127	8.1.3.2	Modulation	0	available
		127	8.1.3.2	Modulation	0	available
		127	8.1.3.2	Modulation	0	available
		127	8.1.3.2	Modulation	0	available
		127	8.1.3.2	Modulation	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available

		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	withdrawn
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
	Late contribution	133	8.1.4.5	Other	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available

		130	8.1.4.2	Multi-antenna scheme	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		137	8.1.5.3	Mobility	0	**available**
		137	8.1.5.3	Mobility	0	**available**
	Late contribution	137	8.1.5.3	Mobility	0	withdrawn
		137	8.1.5.3	Mobility	0	**available**
		137	8.1.5.3	Mobility	0	**available**

		140	8.1.6.1	Resource assignment and interference handling	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	**noted**
		140	8.1.6.1	Resource assignment and interference handling	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		146	8.1.7.3	Other	0	**available**
		146	8.1.7.3	Other	0	**available**
		147	8.1.8	Other	0	**available**
		147	8.1.8	Other	0	**available**
		147	8.1.8	Other	0	**available**
		147	8.1.8	Other	0	**noted**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		124	8.1.2.2	Frame structure	0	**noted**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**

		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		57	7.2.2.3	UL DMRS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**
		86	7.2.8.1	Higher data rates	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**

		133	8.1.4.5	Other	0	available
		137	8.1.5.3	Mobility	0	noted
		5	5	Incoming Liaison Statements	0	noted
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	revised
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	revised
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
	Late contribution	28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	withdrawn
	Late contribution	28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	withdrawn
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		34	7.2.1.1.2	Other	0	available

		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	**available**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**noted**
		40	7.2.1.4	Support of inter-PLMN for Uu and PC5	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**noted**
		43	7.2.1.5.2	Simultaneous Uu and PC5 operations in different carriers	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	**available**
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	**available**
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		54	7.2.2.1.3	Feedback mechanism enhancement	0	**available**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**noted**
		57	7.2.2.3	UL DMRS	0	**noted**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		61	7.2.2.5.2	Hybrid CSI	0	**available**

		64	7.2.3.1	Superposition transmissions	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		86	7.2.8.1	Higher data rates	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**noted**
		100	7.2.9.2	Multicast support	0	**available**
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		103	7.2.9.5	Other	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		120	8.1.1.1	Waveform	0	**noted**

		121	8.1.1.2	Multiple access scheme	0	**available**
	Late contribution	121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**noted**
		123	8.1.2.1	Numerology	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**

		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	noted
		131	8.1.4.3	CSI acquisition	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
	Late contribution	132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	noted
		133	8.1.4.5	Other	0	available
	Late contribution	133	8.1.4.5	Other	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	available

		136	8.1.5.2	RACH procedure	0	available
		137	8.1.5.3	Mobility	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	revised
		140	8.1.6.1	Resource assignment and interference handling	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		141	8.1.6.2	Performance evaluation study	0	available
		144	8.1.7.1	L1/L2 control channel design	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		146	8.1.7.3	Other	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available

		133	8.1.4.5	Other	0	revised
		101	7.2.9.3	Non-anchor PRB enhancements	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		53	7.2.2.1.2	Interference measurement	0	noted
		64	7.2.3.1	Superposition transmissions	0	available
		65	7.2.3.2	Mechanisms for efficient operation	0	available
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	available
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	available
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	available
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	noted
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		120	8.1.1.1	Waveform	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	withdrawn
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available

		136	8.1.5.2	RACH procedure	0	**available**
		137	8.1.5.3	Mobility	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		147	8.1.8	Other	0	**noted**
		123	8.1.2.1	Numerology	0	**noted**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**

		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		129	8.1.4.1	Beam management	0	available
		131	8.1.4.3	CSI acquisition	0	withdrawn
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	withdrawn
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		126	8.1.3.1	Channel coding	0	revised
		126	8.1.3.1	Channel coding	0	revised
		126	8.1.3.1	Channel coding	0	revised
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	available
		65	7.2.3.2	Mechanisms for efficient operation	0	available

		40	7.2.1.4	Support of inter-PLMN for Uu and PC5	0	**available**
		43	7.2.1.5.2	Simultaneous Uu and PC5 operations in different carriers	0	**available**
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**noted**
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	**noted**
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	**available**
		82	7.2.6.3	E-CID enhancements	0	**available**
		82	7.2.6.3	E-CID enhancements	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**available**
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	**available**
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	**available**
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	**available**
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		92	7.2.8.3	OTDOA enhancements	0	**available**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**available**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**

		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**available**
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	**available**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**revised**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**revised**
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	**revised**
		93	7.2.8.4	VoLTE enhancements	0	**available**
		92	7.2.8.3	OTDOA enhancements	0	**available**
		102	7.2.9.4	Power consumption and latency reduction	0	**available**
		102	7.2.9.4	Power consumption and latency reduction	0	**available**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**available**
		120	8.1.1.1	Waveform	0	**noted**
		129	8.1.4.1	Beam management	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**

		126	8.1.3.1	Channel coding	0	**revised**
In this contribution, we provide the summary of link level simulation results of candidate waveforms for NR. We analyze and summarize the results for various cases.		120	8.1.1.1	Waveform	0	**available**
In this contribution, we describe the role of network in choosing the waveform with simulation results.		120	8.1.1.1	Waveform	0	**noted**
In this contribution, we provide our link level simulation results for channel coding schemes for control channel.		126	8.1.3.1	Channel coding	0	**available**
The contribution discusses frame structure design aspects considering key requirements for supporting for eMBB, URLLC, and forward compatibility for wireless data/control backhaul and relays for NR.		124	8.1.2.2	Frame structure	0	**available**

The contribution discusses PHY layer aspects related to initial access and mobility, considering key design requirements for supporting for eMBB, URLLC, and forward compatibility for wireless data/control backhaul and relays for NR.		134	8.1.5	Aspects related to initial access and mobility	0	**available**
In this contribution, we share our view on the NR MIMO CSI feedback framework, which we believe should be generic and adapt to channel environment, including different types of CSI feedback and MIMO transmission schemes. In particular, we view the total MIMO channel as having multiple components from a feedback perspective, where the CSI feedback granularity for each component can be dynamically adjusted by the UE.		132	8.1.4.4	Reference signal design and QCL	0	**noted**
		126	8.1.3.1	Channel coding	0	**available**
		120	8.1.1.1	Waveform	0	**noted**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**

		124	8.1.2.2	Frame structure	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		129	8.1.4.1	Beam management	0	noted
		136	8.1.5.2	RACH procedure	0	available
		86	7.2.8.1	Higher data rates	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	available
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed
		109	7.2.10.3	Other	0	available
		109	7.2.10.3	Other	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		129	8.1.4.1	Beam management	0	available
		40	7.2.1.4	Support of inter-PLMN for Uu and PC5	0	available
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		48	7.2.1.5.7	Other	0	available

		132	8.1.4.4	Reference signal design and QCL	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		131	8.1.4.3	CSI acquisition	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		139	8.1.6	Duplexing	0	available
		141	8.1.6.2	Performance evaluation study	0	available
		141	8.1.6.2	Performance evaluation study	0	revised
		141	8.1.6.2	Performance evaluation study	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	noted
		123	8.1.2.1	Numerology	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		123	8.1.2.1	Numerology	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	available
		124	8.1.2.2	Frame structure	0	available

		147	8.1.8	Other	0	available
		144	8.1.7.1	L1/L2 control channel design	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		137	8.1.5.3	Mobility	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		126	8.1.3.1	Channel coding	0	available
		52	7.2.2.1.1	Advanced CSI	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	revised
		121	8.1.1.2	Multiple access scheme	0	revised
		133	8.1.4.5	Other	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		147	8.1.8	Other	0	available
		138	8.1.5.4	Other	0	available
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	revised
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	revised
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	revised

		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**available**
		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	**available**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**noted**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**available**
		57	7.2.2.3	UL DMRS	0	**noted**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		72	7.2.4.4	PBCH coverage enhancement	0	**available**

		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	noted
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	noted
		76	7.2.5.2	DCI design	0	available
		77	7.2.5.3	Details of collision handling	0	available
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	available
		86	7.2.8.1	Higher data rates	0	available
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	available
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	available
		91	7.2.8.2	Multicast support	0	available
		93	7.2.8.4	VoLTE enhancements	0	available
		100	7.2.9.2	Multicast support	0	available
		101	7.2.9.3	Non-anchor PRB enhancements	0	available
		102	7.2.9.4	Power consumption and latency reduction	0	withdrawn
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		108	7.2.10.2.2	Processing time	0	available
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	available
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	available

		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	**noted**
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**revised**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**noted**

		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		127	8.1.3.2	Modulation	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	revised
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		133	8.1.4.5	Other	0	available
		133	8.1.4.5	Other	0	available
		133	8.1.4.5	Other	0	available

		136	8.1.5.2	RACH procedure	0	**noted**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**noted**
		147	8.1.8	Other	0	**available**
		147	8.1.8	Other	0	**noted**
		147	8.1.8	Other	0	**noted**
		53	7.2.2.1.2	Interference measurement	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**revised**
		124	8.1.2.2	Frame structure	0	**available**
	Late contribution	132	8.1.4.4	Reference signal design and QCL	0	withdrawn
	For email approval	29	7.1.9	Other	0	**agreed**
		121	8.1.1.2	Multiple access scheme	0	**available**
		124	8.1.2.2	Frame structure	0	**available**

		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		137	8.1.5.3	Mobility	0	available
		120	8.1.1.1	Waveform	0	available
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	noted
		65	7.2.3.2	Mechanisms for efficient operation	0	available
		120	8.1.1.1	Waveform	0	noted
		120	8.1.1.1	Waveform	0	available
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available

		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available

		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		120	8.1.1.1	Waveform	0	**revised**
		120	8.1.1.1	Waveform	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		66	7.2.3.3	Evaluation for MUST using up to 8Tx	0	**noted**

		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		91	7.2.8.2	Multicast support	0	available
		123	8.1.2.1	Numerology	0	revised
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	withdrawn
		136	8.1.5.2	RACH procedure	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		126	8.1.3.1	Channel coding	0	available
		64	7.2.3.1	Superposition transmissions	0	noted
		64	7.2.3.1	Superposition transmissions	0	available
		65	7.2.3.2	Mechanisms for efficient operation	0	available
		124	8.1.2.2	Frame structure	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		147	8.1.8	Other	0	available
		124	8.1.2.2	Frame structure	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available

		144	8.1.7.1	L1/L2 control channel design	0	available
	Co-sourced by Verizon Wireless	123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	available
	Co-sourced by Verizon Wireless	140	8.1.6.1	Resource assignment and interference handling	0	available
	Co-sourced by Verizon Wireless	124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	available
	Co-sourced by Verizon Wireless	127	8.1.3.2	Modulation	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		123	8.1.2.1	Numerology	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		123	8.1.2.1	Numerology	0	available
	Late contribution	120	8.1.1.1	Waveform	0	withdrawn
		120	8.1.1.1	Waveform	0	revised
		123	8.1.2.1	Numerology	0	available

		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**

		123	8.1.2.1	Numerology	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**noted**
	Co-sourced by Verizon Wireless	136	8.1.5.2	RACH procedure	0	**available**
	Co-sourced by Verizon Wireless	136	8.1.5.2	RACH procedure	0	**available**
		137	8.1.5.3	Mobility	0	**available**
		70	7.2.4.2	MBSFN-RS pattern for longer cyclic prefix	0	**noted**

		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**noted**
		72	7.2.4.4	PBCH coverage enhancement	0	**available**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**not pursued**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**noted**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		100	7.2.9.2	Multicast support	0	**available**
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	**noted**
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	**available**
		76	7.2.5.2	DCI design	0	**available**
		77	7.2.5.3	Details of collision handling	0	**available**
		77	7.2.5.3	Details of collision handling	0	**available**
		77	7.2.5.3	Details of collision handling	0	**available**
		77	7.2.5.3	Details of collision handling	0	**available**
		128	8.1.4	Multi-antenna scheme for new radio interface	0	**available**
		129	8.1.4.1	Beam management	0	**available**
		129	8.1.4.1	Beam management	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		131	8.1.4.3	CSI acquisition	0	**noted**
		132	8.1.4.4	Reference signal design and QCL	0	**available**

		138	8.1.5.4	Other	0	withdrawn
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		137	8.1.5.3	Mobility	0	**available**
		147	8.1.8	Other	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**noted**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**available**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		147	8.1.8	Other	0	**available**
		147	8.1.8	Other	0	**available**

		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	**noted**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**available**
		34	7.2.1.1.2	Other	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**noted**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		134	8.1.5	Aspects related to initial access and mobility	0	**revised**
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	**noted**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		133	8.1.4.5	Other	0	**available**
		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	**available**
		35	7.2.1.2	Resource selection for pedestrian UEs	0	**available**
	Late contribution	123	8.1.2.1	Numerology	0	withdrawn
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**available**
		48	7.2.1.5.7	Other	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**

		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	**available**
		136	8.1.5.2	RACH procedure	0	**noted**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**noted**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**

		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		48	7.2.1.5.7	Other	0	withdrawn
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**available**
		147	8.1.8	Other	0	**available**
		129	8.1.4.1	Beam management	0	**noted**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	withdrawn
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	withdrawn
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**

		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		147	8.1.8	Other	0	noted
		147	8.1.8	Other	0	withdrawn
		148	8.2	Other	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	postponed
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
Address the issue of forward compatibility for satellite access that needs to be considered during the phase 1 design of the new radio.		147	8.1.8	Other	0	available
		15	6.3.1	DRX improvements	0	agreed
		121	8.1.1.2	Multiple access scheme	0	noted
		15	6.3.1	DRX improvements	0	agreed
		148	8.2	Other	0	noted
		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	available

		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	**available**
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**available**
		123	8.1.2.1	Numerology	0	**available**
		120	8.1.1.1	Waveform	0	**available**
	Rel-6 TR on Spatial channel model for Multiple Input Multiple Output (MIMO) simulations	148	8.2	Other	0	**agreed**
	Rel-9 internal TR on E-UTRA; Further advancements for E-UTRA physical layer aspects	148	8.2	Other	0	**agreed**
	Rel-12 internal TR on Study on 3D channel model for LTE	148	8.2	Other	0	**agreed**
		148	8.2	Other	0	**agreed**
		148	8.2	Other	0	**revised**
		148	8.2	Other	0	**agreed**
		148	8.2	Other	0	**agreed**

This is a discussion paper on the basic time domain structure, analyze motivation and key points of the unified NR frame structure, then give our views on the unified NR frame structure design for grant-based and grant-free access, and at last provide proposals.		124	8.1.2.2	Frame structure	0	**available**
In this paper we discuss the different design aspect of grant-free transmission and make some proposals.		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
This is a discussion paper on where we present our views on high frequency band of unlicensed spectrum in NR and make some proposals.		147	8.1.8	Other	0	**available**
This is a discussion paper on requirements, usage scenarios, operation modes and some design considerations for NR operation in unlicensed spectrum and also provide some observations and proposals.		147	8.1.8	Other	0	**available**
This is a discussion paper on we discuss details of V2X SPS resource configuration and trigger/release indication on Sidelink and Uu, and made some proposals.		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**available**

This is a discussion paper on the details of random selection by P-UEs and proposals are made.		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	**available**
This discussion paper focused on partial sensing for P-UEs and includes the some proposals.		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
In this contribution, we discussed some schemes for coexistence between DSRC and LTE-based V2V on the same channel and provide some proposals.		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**available**
In this paper, we discuss measurement metric of congestion and present some schemes for congestion control and make some proposals.		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	**available**
In this paper, we discuss the remaining details of sidelink synchronization and make some proposals.		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**available**
In this contribution, we discuss some aspects about support traffic with smaller periodicity, the contents include existing technical analysis and necessary enhancement and made some proposals.		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	**available**
This is a TP on PSBCH		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**available**

This is a discussion paper on discussion on [3] dB offset with PSCCH and PSSCH.		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**noted**
		120	8.1.1.1	Waveform	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
This is a TP on random selection of PSCCH cyclic shift.		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**
		106	7.2.10.2	Shortened TTI length together with shortened processing time	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		106	7.2.10.2	Shortened TTI length together with shortened processing time	0	**available**
		106	7.2.10.2	Shortened TTI length together with shortened processing time	0	**available**
		29	7.1.9	Other	0	**agreed**
		120	8.1.1.1	Waveform	0	**available**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**revised**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**revised**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	**available**

		91	7.2.8.2	Multicast support	0	**available**
		100	7.2.9.2	Multicast support	0	**available**
		102	7.2.9.4	Power consumption and latency reduction	0	**available**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**available**
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	**noted**
		103	7.2.9.5	Other	0	**available**
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		92	7.2.8.3	OTDOA enhancements	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**noted**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**available**
		57	7.2.2.3	UL DMRS	0	**available**
		57	7.2.2.3	UL DMRS	0	**noted**
		57	7.2.2.3	UL DMRS	0	**noted**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**noted**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**available**

		61	7.2.2.5.2	Hybrid CSI	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**noted**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		52	7.2.2.1.1	Advanced CSI	0	**available**
		54	7.2.2.1.3	Feedback mechanism enhancement	0	**available**
		54	7.2.2.1.3	Feedback mechanism enhancement	0	**available**
		53	7.2.2.1.2	Interference measurement	0	**noted**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**noted**
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	**noted**
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	**noted**
		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	**available**
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		100	7.2.9.2	Multicast support	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**

		121	8.1.1.2	Multiple access scheme	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		129	8.1.4.1	Beam management	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	withdrawn
		76	7.2.5.2	DCI design	0	**available**
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	**noted**
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	**available**
		58	7.2.2.4	Non-precoded CSI-RS	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		120	8.1.1.1	Waveform	0	**available**
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**available**
		120	8.1.1.1	Waveform	0	**available**

In this contribution we discuss the requirements and challenges brought by the high speed train and propose to consider the requirements of the high speed train and cope with the challenges brought by the future railway mobile communication of the high speed train in the design of NR.		147	8.1.8	Other	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		123	8.1.2.1	Numerology	0	**noted**
		126	8.1.3.1	Channel coding	0	**revised**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**noted**
		128	8.1.4	Multi-antenna scheme for new radio interface	0	**available**

		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	noted
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	available
		124	8.1.2.2	Frame structure	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		52	7.2.2.1.1	Advanced CSI	0	noted
		52	7.2.2.1.1	Advanced CSI	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		57	7.2.2.3	UL DMRS	0	noted
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	revised

		61	7.2.2.5.2	Hybrid CSI	0	**available**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**noted**
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	**available**
		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		66	7.2.3.3	Evaluation for MUST using up to 8Tx	0	**noted**
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	**available**
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	**available**
		5	5	Incoming Liaison Statements	0	**revised**
		5	5	Incoming Liaison Statements	0	withdrawn
		5	5	Incoming Liaison Statements	0	**noted**
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	**noted**
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	**not pursued**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**revised**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**not pursued**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**revised**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**revised**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**revised**

		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	postponed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	postponed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	postponed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	available
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	available

		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	revised
		40	7.2.1.4	Support of inter-PLMN for Uu and PC5	0	available
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	noted
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	available
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	available
		52	7.2.2.1.1	Advanced CSI	0	noted
		53	7.2.2.1.2	Interference measurement	0	noted
		54	7.2.2.1.3	Feedback mechanism enhancement	0	available
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	available
		56	7.2.2.2	Open-loop and Semi-open-loop	0	noted
		57	7.2.2.3	UL DMRS	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		61	7.2.2.5.2	Hybrid CSI	0	available
		64	7.2.3.1	Superposition transmissions	0	available
		64	7.2.3.1	Superposition transmissions	0	available
		65	7.2.3.2	Mechanisms for efficient operation	0	available

		65	7.2.3.2	Mechanisms for efficient operation	0	**available**
		69	7.2.4.1	Longer cyclic prefix for MBSFN subframe	0	**noted**
		70	7.2.4.2	MBSFN-RS pattern for longer cyclic prefix	0	**noted**
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**noted**
		72	7.2.4.4	PBCH coverage enhancement	0	**noted**
		72	7.2.4.4	PBCH coverage enhancement	0	**available**
		75	7.2.5.1	Procedures and configurations for SRS/RACH switching and transmission	0	**available**
		76	7.2.5.2	DCI design	0	**available**
		77	7.2.5.3	Details of collision handling	0	**available**
		78	7.2.5.4	Other	0	**available**
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	**available**
		81	7.2.6.2	PRS-based beacons	0	**available**
		81	7.2.6.2	PRS-based beacons	0	**available**
		81	7.2.6.2	PRS-based beacons	0	**available**
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	**available**
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	**available**
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	**available**
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	**available**
		91	7.2.8.2	Multicast support	0	**available**
		92	7.2.8.3	OTDOA enhancements	0	**available**

		93	7.2.8.4	VoLTE enhancements	0	**available**
		94	7.2.8.5	Other	0	**available**
		94	7.2.8.5	Other	0	**available**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**noted**
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	**noted**
		100	7.2.9.2	Multicast support	0	**noted**
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		102	7.2.9.4	Power consumption and latency reduction	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		108	7.2.10.2.2	Processing time	0	**available**
		109	7.2.10.3	Other	0	**available**
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	**available**
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	**revised**
		120	8.1.1.1	Waveform	0	**available**
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	**available**

		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	available
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	noted
		100	7.2.9.2	Multicast support	0	available
		102	7.2.9.4	Power consumption and latency reduction	0	noted
		102	7.2.9.4	Power consumption and latency reduction	0	available
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	available
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	available
		100	7.2.9.2	Multicast support	0	available
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		53	7.2.2.1.2	Interference measurement	0	noted
		54	7.2.2.1.3	Feedback mechanism enhancement	0	available
		56	7.2.2.2	Open-loop and Semi-open-loop	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		61	7.2.2.5.2	Hybrid CSI	0	available

		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	available
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	noted
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	available
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		64	7.2.3.1	Superposition transmissions	0	available
		65	7.2.3.2	Mechanisms for efficient operation	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	noted
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		108	7.2.10.2.2	Processing time	0	available
		108	7.2.10.2.2	Processing time	0	available
		124	8.1.2.2	Frame structure	0	available
		118	8.1	Study on New Radio Access Technology - SID in RP-161596	0	available
		118	8.1	Study on New Radio Access Technology - SID in RP-161596	0	revised
		120	8.1.1.1	Waveform	0	noted

		123	8.1.2.1	Numerology	0	noted
		136	8.1.5.2	RACH procedure	0	noted
		136	8.1.5.2	RACH procedure	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	noted
		124	8.1.2.2	Frame structure	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		131	8.1.4.3	CSI acquisition	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		133	8.1.4.5	Other	0	available
		133	8.1.4.5	Other	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	revised
		137	8.1.5.3	Mobility	0	available
		121	8.1.1.2	Multiple access scheme	0	available

	Late contribution	121	8.1.1.2	Multiple access scheme	0	available
	Late contribution	121	8.1.1.2	Multiple access scheme	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		144	8.1.7.1	L1/L2 control channel design	0	noted
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		141	8.1.6.2	Performance evaluation study	0	revised
		141	8.1.6.2	Performance evaluation study	0	noted
		124	8.1.2.2	Frame structure	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		147	8.1.8	Other	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		22	7.1.2	Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available

		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		108	7.2.10.2.2	Processing time	0	available
		52	7.2.2.1.1	Advanced CSI	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		133	8.1.4.5	Other	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		29	7.1.9	Other	0	noted
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		147	8.1.8	Other	0	available
		29	7.1.9	Other	0	revised
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	noted
		120	8.1.1.1	Waveform	0	available
		132	8.1.4.4	Reference signal design and QCL	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	available
		121	8.1.1.2	Multiple access scheme	0	available

		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		123	8.1.2.1	Numerology	0	available
		123	8.1.2.1	Numerology	0	noted
		123	8.1.2.1	Numerology	0	noted
		123	8.1.2.1	Numerology	0	noted
		123	8.1.2.1	Numerology	0	available
		124	8.1.2.2	Frame structure	0	withdrawn
		124	8.1.2.2	Frame structure	0	noted
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		124	8.1.2.2	Frame structure	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	revised
		126	8.1.3.1	Channel coding	0	available

		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**revised**
		126	8.1.3.1	Channel coding	0	**available**
		127	8.1.3.2	Modulation	0	**available**
		129	8.1.4.1	Beam management	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	withdrawn
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	withdrawn

		136	8.1.5.2	RACH procedure	0	available
		136	8.1.5.2	RACH procedure	0	revised
		136	8.1.5.2	RACH procedure	0	available
		137	8.1.5.3	Mobility	0	withdrawn
		137	8.1.5.3	Mobility	0	revised
		137	8.1.5.3	Mobility	0	available
		137	8.1.5.3	Mobility	0	available
		137	8.1.5.3	Mobility	0	available
		137	8.1.5.3	Mobility	0	available
		137	8.1.5.3	Mobility	0	available
		137	8.1.5.3	Mobility	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		145	8.1.7.2	Scheduling/HARQ mechanism	0	available
		147	8.1.8	Other	0	noted
		147	8.1.8	Other	0	available

		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		144	8.1.7.1	L1/L2 control channel design	0	available
		140	8.1.6.1	Resource assignment and interference handling	0	available
		12	6.2.2	Power scaling	0	noted
		11	6.2.1	TTI switching	0	noted
		13	6.2.3	Other	0	noted
		13	6.2.3	Other	0	noted
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	noted

		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	withdrawn
		101	7.2.9.3	Non-anchor PRB enhancements	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**available**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**noted**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**available**
		127	8.1.3.2	Modulation	0	**noted**
		36	7.2.1.2.1	Details of random selection by pedestrian UEs	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**available**
RSTD reporting enhancement in OTDOA		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	**available**
Discussion for PRS-based beacon.		81	7.2.6.2	PRS-based beacons	0	**revised**
		124	8.1.2.2	Frame structure	0	**available**
		145	8.1.7.2	Scheduling/HARQ mechanism	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	**noted**

		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	**available**
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	**available**
		100	7.2.9.2	Multicast support	0	**available**
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	**available**
		120	8.1.1.1	Waveform	0	**noted**
		148	8.2	Other	0	**agreed**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		124	8.1.2.2	Frame structure	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		11	6.2.1	TTI switching	0	**noted**
		12	6.2.2	Power scaling	0	**noted**
		13	6.2.3	Other	0	**noted**
		13	6.2.3	Other	0	**noted**

		16	6.3.2	DTX improvements	0	noted
		120	8.1.1.1	Waveform	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	withdrawn
		129	8.1.4.1	Beam management	0	available
		129	8.1.4.1	Beam management	0	revised
		129	8.1.4.1	Beam management	0	available
		130	8.1.4.2	Multi-antenna scheme	0	available

		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	withdrawn
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**

		131	8.1.4.3	CSI acquisition	0	**noted**
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		131	8.1.4.3	CSI acquisition	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		133	8.1.4.5	Other	0	**available**

		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		133	8.1.4.5	Other	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**

		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	withdrawn
		137	8.1.5.3	Mobility	0	**revised**
		137	8.1.5.3	Mobility	0	**available**
		123	8.1.2.1	Numerology	0	**available**
	Late contribution	121	8.1.1.2	Multiple access scheme	0	**available**
		112	7.2.13	Study on Further enhancements to Coordinated Multi-Point Operation - SID in RP-160954	0	**endorsed**
		123	8.1.2.1	Numerology	0	**noted**
		40	7.2.1.4	Support of inter-PLMN for Uu and PC5	0	**available**
		48	7.2.1.5.7	Other	0	**noted**
		56	7.2.2.2	Open-loop and Semi-open-loop	0	**available**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	**noted**
		124	8.1.2.2	Frame structure	0	**available**
CR to 36.213 Category F WI Code: LTE_MTCe2_L1-Core		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**not pursued**
		120	8.1.1.1	Waveform	0	**available**

		70	7.2.4.2	MBSFN-RS pattern for longer cyclic prefix	0	**noted**
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**noted**
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**noted**
		148	8.2	Other	0	**postponed**
		126	8.1.3.1	Channel coding	0	**available**
		147	8.1.8	Other	0	**available**
		147	8.1.8	Other	0	**available**
		132	8.1.4.4	Reference signal design and QCL	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
	Revision of R1-167332 and not R1-167333	129	8.1.4.1	Beam management	0	**available**
		136	8.1.5.2	RACH procedure	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**revised**

		107	7.2.10.2.1	Design of sTTI for DL and UL	0	noted
		108	7.2.10.2.2	Processing time	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	noted
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		129	8.1.4.1	Beam management	0	available
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	available
		100	7.2.9.2	Multicast support	0	available
		102	7.2.9.4	Power consumption and latency reduction	0	revised
		102	7.2.9.4	Power consumption and latency reduction	0	revised

		126	8.1.3.1	Channel coding	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		137	8.1.5.3	Mobility	0	withdrawn
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		72	7.2.4.4	PBCH coverage enhancement	0	available
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	available
		147	8.1.8	Other	0	noted
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available
		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	available
		61	7.2.2.5.2	Hybrid CSI	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		147	8.1.8	Other	0	available
		147	8.1.8	Other	0	available

		147	8.1.8	Other	0	**available**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**not pursued**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**revised**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	withdrawn
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		121	8.1.1.2	Multiple access scheme	0	**available**
		126	8.1.3.1	Channel coding	0	**revised**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**noted**
	Late contribution	98	7.2.9.1.2	Evaluation of narrowband OTDOA positioning	0	withdrawn
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**noted**
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	**available**
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	**available**
		81	7.2.6.2	PRS-based beacons	0	**available**
		82	7.2.6.3	E-CID enhancements	0	**available**
		83	7.2.6.4	Other	0	**available**

		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	available
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	available
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	available
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	available
		91	7.2.8.2	Multicast support	0	available
		91	7.2.8.2	Multicast support	0	available
		92	7.2.8.3	OTDOA enhancements	0	available
		93	7.2.8.4	VoLTE enhancements	0	available
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	noted
		120	8.1.1.1	Waveform	0	revised
		102	7.2.9.4	Power consumption and latency reduction	0	revised
		102	7.2.9.4	Power consumption and latency reduction	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		136	8.1.5.2	RACH procedure	0	withdrawn
		137	8.1.5.3	Mobility	0	available
		120	8.1.1.1	Waveform	0	available
		120	8.1.1.1	Waveform	0	withdrawn
		129	8.1.4.1	Beam management	0	available
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	available
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	available

		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**not pursued**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**not pursued**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**revised**
	Late contribution	126	8.1.3.1	Channel coding	0	**available**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**not pursued**
	Late contribution - For email approval	21	7.1.1	Maintenance of E-UTRA Release 8 – 12	0	**noted**
	Late contribution	137	8.1.5.3	Mobility	0	**available**
		140	8.1.6.1	Resource assignment and interference handling	0	**noted**
		137	8.1.5.3	Mobility	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**noted**
		126	8.1.3.1	Channel coding	0	**available**
		126	8.1.3.1	Channel coding	0	**noted**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**revised**
		134	8.1.5	Aspects related to initial access and mobility	0	**available**
		126	8.1.3.1	Channel coding	0	**revised**
		61	7.2.2.5.2	Hybrid CSI	0	**available**
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	**available**

		123	8.1.2.1	Numerology	0	available
Discussion for PRS-based beacon.		81	7.2.6.2	PRS-based beacons	0	available
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	revised
		132	8.1.4.4	Reference signal design and QCL	0	available
		102	7.2.9.4	Power consumption and latency reduction	0	noted
		102	7.2.9.4	Power consumption and latency reduction	0	noted
		102	7.2.9.4	Power consumption and latency reduction	0	available
		102	7.2.9.4	Power consumption and latency reduction	0	available
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		147	8.1.8	Other	0	noted
		129	8.1.4.1	Beam management	0	available
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	available
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		2	2	Approval of Agenda	0	approved
		120	8.1.1.1	Waveform	0	available
		136	8.1.5.2	RACH procedure	0	available

		133	8.1.4.5	Other	0	available
		108	7.2.10.2.2	Processing time	0	available
		133	8.1.4.5	Other	0	available
		120	8.1.1.1	Waveform	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		121	8.1.1.2	Multiple access scheme	0	revised
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	withdrawn
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	agreed
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	agreed
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	agreed
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	agreed
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	agreed
		24	7.1.4	Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed

		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	not pursued
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	revised
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	withdrawn
		100	7.2.9.2	Multicast support	0	available
		100	7.2.9.2	Multicast support	0	available
		101	7.2.9.3	Non-anchor PRB enhancements	0	available
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	revised
		126	8.1.3.1	Channel coding	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available

		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		121	8.1.1.2	Multiple access scheme	0	available
		148	8.2	Other	0	agreed
		141	8.1.6.2	Performance evaluation study	0	available
		130	8.1.4.2	Multi-antenna scheme	0	withdrawn
		124	8.1.2.2	Frame structure	0	available
		123	8.1.2.1	Numerology	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	noted

		120	8.1.1.1	Waveform	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	revised
		129	8.1.4.1	Beam management	0	noted
		123	8.1.2.1	Numerology	0	noted
		136	8.1.5.2	RACH procedure	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed

		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		123	8.1.2.1	Numerology	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		123	8.1.2.1	Numerology	0	revised
		123	8.1.2.1	Numerology	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	available
		123	8.1.2.1	Numerology	0	revised
		131	8.1.4.3	CSI acquisition	0	noted

		129	8.1.4.1	Beam management	0	revised
		129	8.1.4.1	Beam management	0	noted
		129	8.1.4.1	Beam management	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		129	8.1.4.1	Beam management	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	revised
		130	8.1.4.2	Multi-antenna scheme	0	revised
		132	8.1.4.4	Reference signal design and QCL	0	noted
		123	8.1.2.1	Numerology	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	available
		132	8.1.4.4	Reference signal design and QCL	0	noted

		130	8.1.4.2	Multi-antenna scheme	0	revised
		130	8.1.4.2	Multi-antenna scheme	0	revised
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	revised
		121	8.1.1.2	Multiple access scheme	0	revised
		132	8.1.4.4	Reference signal design and QCL	0	revised
		131	8.1.4.3	CSI acquisition	0	revised
		131	8.1.4.3	CSI acquisition	0	revised
		131	8.1.4.3	CSI acquisition	0	revised
		130	8.1.4.2	Multi-antenna scheme	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		129	8.1.4.1	Beam management	0	revised
		123	8.1.2.1	Numerology	0	noted

		126	8.1.3.1	Channel coding	0	revised
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	available
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	noted
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	revised
		124	8.1.2.2	Frame structure	0	revised
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		100	7.2.9.2	Multicast support	0	noted
		100	7.2.9.2	Multicast support	0	noted
		100	7.2.9.2	Multicast support	0	available
		101	7.2.9.3	Non-anchor PRB enhancements	0	available
		101	7.2.9.3	Non-anchor PRB enhancements	0	withdrawn

		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	**noted**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**noted**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		136	8.1.5.2	RACH procedure	0	**available**
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	**noted**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**available**
		5	5	Incoming Liaison Statements	0	**postponed**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**

		106	7.2.10.2	Shortened TTI length together with shortened processing time	0	available
		57	7.2.2.3	UL DMRS	0	available
		13	6.2.3	Other	0	approved
		11	6.2.1	TTI switching	0	approved
		6	6	UTRA	0	endorsed
		6	6	UTRA	0	withdrawn
		6	6	UTRA	0	withdrawn
		6	6	UTRA	0	withdrawn
		6	6	UTRA	0	withdrawn
		6	6	UTRA	0	withdrawn
		6	6	UTRA	0	withdrawn
		126	8.1.3.1	Channel coding	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	revised
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	noted
		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	revised
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	revised
		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	withdrawn

		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	withdrawn
		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	withdrawn
		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	withdrawn
		137	8.1.5.3	Mobility	0	noted
		57	7.2.2.3	UL DMRS	0	noted
		56	7.2.2.2	Open-loop and Semi-open-loop	0	revised
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		58	7.2.2.4	Non-precoded CSI-RS	0	revised
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		57	7.2.2.3	UL DMRS	0	available
		56	7.2.2.2	Open-loop and Semi-open-loop	0	available
		30	7.2	LTE Release 14	0	withdrawn
		126	8.1.3.1	Channel coding	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	revised
		58	7.2.2.4	Non-precoded CSI-RS	0	noted

		53	7.2.2.1.2	Interference measurement	0	**available**
		126	8.1.3.1	Channel coding	0	**noted**
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**revised**
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	**revised**
		126	8.1.3.1	Channel coding	0	**available**
		30	7.2	LTE Release 14	0	withdrawn
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	**revised**
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	**endorsed**
		57	7.2.2.3	UL DMRS	0	**noted**

		57	7.2.2.3	UL DMRS	0	noted
		56	7.2.2.2	Open-loop and Semi-open-loop	0	noted
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	withdrawn
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	noted
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		92	7.2.8.3	OTDOA enhancements	0	noted
		124	8.1.2.2	Frame structure	0	noted
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		140	8.1.6.1	Resource assignment and interference handling	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		58	7.2.2.4	Non-precoded CSI-RS	0	withdrawn

		86	7.2.8.1	Higher data rates	0	noted
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		130	8.1.4.2	Multi-antenna scheme	0	revised
		141	8.1.6.2	Performance evaluation study	0	noted
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	noted
		52	7.2.2.1.1	Advanced CSI	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	noted

		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	available
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	noted
		100	7.2.9.2	Multicast support	0	noted
		100	7.2.9.2	Multicast support	0	noted
		100	7.2.9.2	Multicast support	0	noted
		102	7.2.9.4	Power consumption and latency reduction	0	revised
		123	8.1.2.1	Numerology	0	withdrawn
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	noted
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	noted
		123	8.1.2.1	Numerology	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		92	7.2.8.3	OTDOA enhancements	0	revised
		123	8.1.2.1	Numerology	0	approved
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed

		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed
		129	8.1.4.1	Beam management	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		86	7.2.8.1	Higher data rates	0	noted
		86	7.2.8.1	Higher data rates	0	noted
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	noted
		91	7.2.8.2	Multicast support	0	available
		91	7.2.8.2	Multicast support	0	available
		91	7.2.8.2	Multicast support	0	noted
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	revised
		140	8.1.6.1	Resource assignment and interference handling	0	noted
		90	7.2.8.1.4	Number of DL processes in FD-FDD	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	noted

		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	noted
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	noted
		129	8.1.4.1	Beam management	0	withdrawn
		130	8.1.4.2	Multi-antenna scheme	0	withdrawn
		144	8.1.7.1	L1/L2 control channel design	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	noted
		126	8.1.3.1	Channel coding	0	available
		148	8.2	Other	0	agreed
		5	5	Incoming Liaison Statements	0	postponed
		147	8.1.8	Other	0	noted
		126	8.1.3.1	Channel coding	0	available
		144	8.1.7.1	L1/L2 control channel design	0	noted
		88	7.2.8.1.2	Larger max PDSCH/PUSCH channel bandwidth	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		126	8.1.3.1	Channel coding	0	revised

		148	8.2	Other	0	available
		126	8.1.3.1	Channel coding	0	revised
		126	8.1.3.1	Channel coding	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	revised
		130	8.1.4.2	Multi-antenna scheme	0	noted
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	noted
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	noted
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	available
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	available
		148	8.2	Other	0	postponed
		148	8.2	Other	0	postponed
		148	8.2	Other	0	postponed
		148	8.2	Other	0	postponed
		148	8.2	Other	0	postponed
		148	8.2	Other	0	postponed
		131	8.1.4.3	CSI acquisition	0	revised
		91	7.2.8.2	Multicast support	0	available

		91	7.2.8.2	Multicast support	0	**available**
		45	7.2.1.5.4	Handle multiplexing V2V with other signals/channels	0	**noted**
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	**noted**
		144	8.1.7.1	L1/L2 control channel design	0	**revised**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**noted**
		124	8.1.2.2	Frame structure	0	**revised**
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		131	8.1.4.3	CSI acquisition	0	**noted**
		141	8.1.6.2	Performance evaluation study	0	**noted**
		58	7.2.2.4	Non-precoded CSI-RS	0	**noted**
		132	8.1.4.4	Reference signal design and QCL	0	**noted**
		147	8.1.8	Other	0	**noted**

		130	8.1.4.2	Multi-antenna scheme	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		65	7.2.3.2	Mechanisms for efficient operation	0	**noted**
		65	7.2.3.2	Mechanisms for efficient operation	0	**noted**
		131	8.1.4.3	CSI acquisition	0	**revised**
		39	7.2.1.3	Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	0	**noted**
		65	7.2.3.2	Mechanisms for efficient operation	0	**noted**
		65	7.2.3.2	Mechanisms for efficient operation	0	**noted**
		61	7.2.2.5.2	Hybrid CSI	0	**noted**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**noted**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**agreed**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**agreed**

		130	8.1.4.2	Multi-antenna scheme	0	revised
		144	8.1.7.1	L1/L2 control channel design	0	noted
		147	8.1.8	Other	0	available
		132	8.1.4.4	Reference signal design and QCL	0	withdrawn
		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	noted
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	noted
		58	7.2.2.4	Non-precoded CSI-RS	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	agreed
		29	7.1.9	Other	0	revised
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised

		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	withdrawn
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		42	7.2.1.5.1	Congestion control for PC5-based V2X	0	noted
		64	7.2.3.1	Superposition transmissions	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	withdrawn
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	revised
		126	8.1.3.1	Channel coding	0	available
		52	7.2.2.1.1	Advanced CSI	0	available
		61	7.2.2.5.2	Hybrid CSI	0	revised
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		52	7.2.2.1.1	Advanced CSI	0	noted
		52	7.2.2.1.1	Advanced CSI	0	available
		53	7.2.2.1.2	Interference measurement	0	available
		61	7.2.2.5.2	Hybrid CSI	0	available

		5	5	Incoming Liaison Statements	0	**treated**
		5	5	Incoming Liaison Statements	0	**postponed**
		126	8.1.3.1	Channel coding	0	**noted**
		140	8.1.6.1	Resource assignment and interference handling	0	**available**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**available**
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**noted**
		53	7.2.2.1.2	Interference measurement	0	**available**

		52	7.2.2.1.1	Advanced CSI	0	revised
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	noted
		127	8.1.3.2	Modulation	0	available
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		144	8.1.7.1	L1/L2 control channel design	0	available
		29	7.1.9	Other	0	approved
		52	7.2.2.1.1	Advanced CSI	0	available
		114	7.2.13.2	Initial evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO	0	noted
		136	8.1.5.2	RACH procedure	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	noted

		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	withdrawn
		61	7.2.2.5.2	Hybrid CSI	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		106	7.2.10.2	Shortened TTI length together with shortened processing time	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		124	8.1.2.2	Frame structure	0	**revised**
		123	8.1.2.1	Numerology	0	**noted**
		147	8.1.8	Other	0	**revised**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	withdrawn
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**agreed**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**agreed**
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	**treated**

		127	8.1.3.2	Modulation	0	**noted**
		147	8.1.8	Other	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		64	7.2.3.1	Superposition transmissions	0	**noted**
		66	7.2.3.3	Evaluation for MUST using up to 8Tx	0	**noted**
		126	8.1.3.1	Channel coding	0	**available**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		65	7.2.3.2	Mechanisms for efficient operation	0	**noted**

		123	8.1.2.1	Numerology	0	noted
		144	8.1.7.1	L1/L2 control channel design	0	available
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	noted
		33	7.2.1.1.1	DCI design to support multiple SPS configurations	0	noted
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	noted
	Late contribution	60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	available
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	revised
		121	8.1.1.2	Multiple access scheme	0	noted
		113	7.2.13.1	Initial evaluation results and enhancements for non-coherent joint transmission	0	noted
		91	7.2.8.2	Multicast support	0	noted
		126	8.1.3.1	Channel coding	0	available
		126	8.1.3.1	Channel coding	0	available
		120	8.1.1.1	Waveform	0	withdrawn
		89	7.2.8.1.3	HARQ-ACK bundling in HD-FDD	0	noted
		129	8.1.4.1	Beam management	0	noted

		121	8.1.1.2	Multiple access scheme	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**agreed**
		137	8.1.5.3	Mobility	0	**noted**
		132	8.1.4.4	Reference signal design and QCL	0	**revised**
		65	7.2.3.2	Mechanisms for efficient operation	0	**revised**
		130	8.1.4.2	Multi-antenna scheme	0	**agreed**
		105	7.2.10.1	Shortened processing time for 1ms TTI	0	**available**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**

		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	available
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	available
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	revised
		126	8.1.3.1	Channel coding	0	available
		118	8.1	Study on New Radio Access Technology - SID in RP-161596	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
		137	8.1.5.3	Mobility	0	noted
		136	8.1.5.2	RACH procedure	0	revised
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	revised
		118	8.1	Study on New Radio Access Technology - SID in RP-161596	0	endorsed
		136	8.1.5.2	RACH procedure	0	noted

		126	8.1.3.1	Channel coding	0	**noted**
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	withdrawn
	For email approval	22	7.1.2	Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers	0	**noted**
	For email approval	27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**noted**
		136	8.1.5.2	RACH procedure	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	**noted**
		126	8.1.3.1	Channel coding	0	**available**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**postponed**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**revised**

		126	8.1.3.1	Channel coding	0	revised
		87	7.2.8.1.1	Larger max PDSCH/PUSCH TBS	0	noted
		20	7.1	Maintenance of E-UTRA Releases 8 – 14	0	withdrawn
		20	7.1	Maintenance of E-UTRA Releases 8 – 14	0	withdrawn
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	endorsed
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	revised
		63	7.2.3	Downlink Multiuser Superposition Transmission for LTE - WID in RP-161019	0	endorsed
		68	7.2.4	eMBMS enhancements for LTE - WID in RP-161297	0	endorsed
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	endorsed
		79	7.2.6	Further Indoor Positioning enhancements for UTRA and LTE - WID in RP-161850	0	endorsed
		84	7.2.7	Uplink Capacity Enhancements for LTE - WID in RP-160664	0	endorsed
		85	7.2.8	Further Enhanced MTC for LTE - WID in RP-161464	0	endorsed
		95	7.2.9	Enhancements of NB-IoT - WID in RP-161901	0	endorsed
		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	endorsed
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	endorsed
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	endorsed
		112	7.2.13	Study on Further enhancements to Coordinated Multi-Point Operation - SID in RP-160954	0	endorsed
		119	8.1.1	Waveform and multiple access schemes for new radio interface	0	endorsed

		125	8.1.3	Channel coding and modulation for new radio interface	0	**endorsed**
		139	8.1.6	Duplexing	0	**endorsed**
		147	8.1.8	Other	0	**endorsed**
		148	8.2	Other	0	**endorsed**
		20	7.1	Maintenance of E-UTRA Releases 8 – 14	0	**endorsed**
		144	8.1.7.1	L1/L2 control channel design	0	**noted**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**agreed**
		126	8.1.3.1	Channel coding	0	**withdrawn**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**agreed**
		144	8.1.7.1	L1/L2 control channel design	0	**available**
		133	8.1.4.5	Other	0	**agreed**
		133	8.1.4.5	Other	0	**agreed**
		133	8.1.4.5	Other	0	**noted**

		129	8.1.4.1	Beam management	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	withdrawn
		130	8.1.4.2	Multi-antenna scheme	0	noted
		129	8.1.4.1	Beam management	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		126	8.1.3.1	Channel coding	0	withdrawn
		130	8.1.4.2	Multi-antenna scheme	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		29	7.1.9	Other	0	revised
		124	8.1.2.2	Frame structure	0	noted
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	noted

	Not co-sourced by Qualcomm	127	8.1.3.2	Modulation	0	noted
		99	7.2.9.1.3	Evaluation of narrowband UTDOA positioning using an existing NB-IoT transmission	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	noted
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	withdrawn
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		26	7.1.6	Maintenance of Release 13 NB-IoT	0	agreed

		26	7.1.6	Maintenance of Release 13 NB-IoT	0	**agreed**
		121	8.1.1.2	Multiple access scheme	0	**available**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**noted**
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	**revised**
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	**noted**
		93	7.2.8.4	VoLTE enhancements	0	**noted**
		129	8.1.4.1	Beam management	0	**noted**
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	**noted**
		124	8.1.2.2	Frame structure	0	**revised**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**agreed**
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	**noted**

		81	7.2.6.2	PRS-based beacons	0	noted
		44	7.2.1.5.3	Remaining enhancement to sidelink synchronization	0	approved
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	approved
		126	8.1.3.1	Channel coding	0	noted
		46	7.2.1.5.5	Support for traffic with smaller periodicity on PC5 based V2V using shorter resource reservation period	0	noted
		69	7.2.4.1	Longer cyclic prefix for MBSFN subframe	0	withdrawn
		92	7.2.8.3	OTDOA enhancements	0	noted
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	available
		131	8.1.4.3	CSI acquisition	0	noted
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	noted
		133	8.1.4.5	Other	0	available
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	available
		60	7.2.2.5.1	Aperiodic and frequency domain reduced overhead CSI-RS	0	noted
		55	7.2.2.1.4	Non-precoded CSI-RS codebook for 20 – 32 ports	0	noted

		144	8.1.7.1	L1/L2 control channel design	0	noted
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	agreed
		145	8.1.7.2	Scheduling/HARQ mechanism	0	noted
		65	7.2.3.2	Mechanisms for efficient operation	0	noted
		64	7.2.3.1	Superposition transmissions	0	noted
		123	8.1.2.1	Numerology	0	noted
		131	8.1.4.3	CSI acquisition	0	noted
		147	8.1.8	Other	0	noted
		124	8.1.2.2	Frame structure	0	noted
		123	8.1.2.1	Numerology	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	revised
		147	8.1.8	Other	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted

		121	8.1.1.2	Multiple access scheme	0	noted
		121	8.1.1.2	Multiple access scheme	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	revised
		136	8.1.5.2	RACH procedure	0	noted
		147	8.1.8	Other	0	noted
		136	8.1.5.2	RACH procedure	0	agreed
		129	8.1.4.1	Beam management	0	withdrawn
		129	8.1.4.1	Beam management	0	noted
		121	8.1.1.2	Multiple access scheme	0	available
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	revised
		130	8.1.4.2	Multi-antenna scheme	0	noted
		100	7.2.9.2	Multicast support	0	noted
		100	7.2.9.2	Multicast support	0	revised
		100	7.2.9.2	Multicast support	0	revised
		129	8.1.4.1	Beam management	0	noted

		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	revised
		47	7.2.1.5.6	Prioritization of SL TX for V2X over WAN TX under eNB management	0	noted
		128	8.1.4	Multi-antenna scheme for new radio interface	0	available
		137	8.1.5.3	Mobility	0	noted
		136	8.1.5.2	RACH procedure	0	revised
		28	7.1.8	Maintenance of Release 14 V2V services based on LTE sidelink	0	noted
		136	8.1.5.2	RACH procedure	0	noted
		136	8.1.5.2	RACH procedure	0	revised
		129	8.1.4.1	Beam management	0	revised
		126	8.1.3.1	Channel coding	0	revised
		126	8.1.3.1	Channel coding	0	available
		130	8.1.4.2	Multi-antenna scheme	0	noted
		126	8.1.3.1	Channel coding	0	available
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	revised
		136	8.1.5.2	RACH procedure	0	agreed

		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	agreed
		48	7.2.1.5.7	Other	0	withdrawn
		48	7.2.1.5.7	Other	0	withdrawn
		136	8.1.5.2	RACH procedure	0	revised
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	revised
		136	8.1.5.2	RACH procedure	0	approved
		126	8.1.3.1	Channel coding	0	available
		102	7.2.9.4	Power consumption and latency reduction	0	noted
		124	8.1.2.2	Frame structure	0	available
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	revised
		126	8.1.3.1	Channel coding	0	withdrawn
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		133	8.1.4.5	Other	0	noted
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	approved

		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	withdrawn
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	withdrawn
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	withdrawn
		50	7.2.2	Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623	0	withdrawn
		144	8.1.7.1	L1/L2 control channel design	0	noted
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	revised
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	agreed
		121	8.1.1.2	Multiple access scheme	0	available
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	revised
		130	8.1.4.2	Multi-antenna scheme	0	noted
		136	8.1.5.2	RACH procedure	0	noted
		132	8.1.4.4	Reference signal design and QCL	0	agreed
		61	7.2.2.5.2	Hybrid CSI	0	noted
		129	8.1.4.1	Beam management	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted

		37	7.2.1.2.2	Details of resource selection using partial sensing by pedestrian UEs	0	**noted**
		93	7.2.8.4	VoLTE enhancements	0	**revised**
		52	7.2.2.1.1	Advanced CSI	0	**noted**
		102	7.2.9.4	Power consumption and latency reduction	0	**noted**
		25	7.1.5	Maintenance of Release 13 further LTE physical layer enhancements for MTC	0	**agreed**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**revised**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**agreed**
		121	8.1.1.2	Multiple access scheme	0	**available**
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	**noted**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**agreed**
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	**approved**
		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	**agreed**
	MCC to change category F to A in R1-1611028.	23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	**agreed**

		23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	agreed
	MCC to change category F to A in R1-1611030.	23	7.1.3	Maintenance of Release 13 Licensed-assisted access to unlicensed spectrum	0	agreed
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	approved
		97	7.2.9.1.1	Design of narrowband OTDOA positioning	0	approved
		100	7.2.9.2	Multicast support	0	approved
		100	7.2.9.2	Multicast support	0	approved
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	noted
	For email discussion	144	8.1.7.1	L1/L2 control channel design	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	noted
		135	8.1.5.1	Synchronization signal and DL broadcast signal/channel	0	agreed
		143	8.1.7	Scheduling/HARQ aspects	0	noted
		122	8.1.2	Numerology and frame structure for new radio interface	0	noted
		124	8.1.2.2	Frame structure	0	noted
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	revised
		124	8.1.2.2	Frame structure	0	withdrawn
		130	8.1.4.2	Multi-antenna scheme	0	noted

		29	7.1.9	Other	0	agreed
		132	8.1.4.4	Reference signal design and QCL	0	noted
		130	8.1.4.2	Multi-antenna scheme	0	revised
		85	7.2.8	Further Enhanced MTC for LTE - WID in RP-161464	0	available
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	approved
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	approved
		71	7.2.4.3	Potential CRS reductions in FeMBMS carrier with less than 100% MBSFN subframes	0	approved
		80	7.2.6.1	Remaining issues for OTDOA enhancements	0	approved
		93	7.2.8.4	VoLTE enhancements	0	approved
		107	7.2.10.2.1	Design of sTTI for DL and UL	0	approved
		104	7.2.10	Shortened TTI and processing time for LTE - WID in RP-161922	0	approved
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	approved
		111	7.2.12	Voice and Video enhancement for LTE - WID in RP-161856	0	approved
		121	8.1.1.2	Multiple access scheme	0	available
		126	8.1.3.1	Channel coding	0	noted
		122	8.1.2	Numerology and frame structure for new radio interface	0	noted
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	revised
		121	8.1.1.2	Multiple access scheme	0	available

		121	8.1.1.2	Multiple access scheme	0	**available**
		130	8.1.4.2	Multi-antenna scheme	0	**noted**
		121	8.1.1.2	Multiple access scheme	0	**noted**
		31	7.2.1	LTE-based V2X Services - WID in RP-161894	0	**approved**
		74	7.2.5	SRS Carrier Based Switching for LTE - WID in RP-160935	0	**available**
		110	7.2.11	Performance enhancements for high speed scenario - WID in RP-152263	0	**available**
		79	7.2.6	Further Indoor Positioning enhancements for UTRA and LTE - WID in RP-161850	0	**available**
		63	7.2.3	Downlink Multiuser Superposition Transmission for LTE - WID in RP-161019	0	**available**
		126	8.1.3.1	Channel coding	0	**available**
		27	7.1.7	Maintenance of Release 14 enhanced licensed-assisted access to Unlicensed Spectrum	0	**agreed**
		102	7.2.9.4	Power consumption and latency reduction	0	**agreed**
		22	7.1.2	Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers	0	**agreed**

Reservation date	Uploaded	Is revision of	Revised to	Release	Spec #	Version	Related WIs	CR #	CR revision #
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			RAN1		R2-167204	
			RAN1		R2-167188	

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			RAN2			

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			RAN1		R2-167189	

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		R1-1608572	RAN4			
		R1-1610798	RAN2			

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			RAN2, RAN4	RAN3		
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		R1-1608566	RAN2			
A						

		R1-1610798	RAN2			
		R1-1608566	RAN2			

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			RAN2			
			RAN2, RAN3, SA2			

			RAN2	RAN3, RAN4		
		R1-163371	RAN4, RAN2			

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			RAN2, RAN4			

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		R1-1608572	RAN4			
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		R1-167908	IEEE 802 LAN/MAN Standards Committee	Wi-Fi Alliance, The City of New York Office of the Mayor, RAN, RAN2, RAN4		
			RAN4			
			RAN2			
			RAN2, RAN3, SA2			
			RAN2	RAN4		

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			RAN2	RAN4		
			RAN2			
			RAN2	RAN3, RAN4		
			RAN2, RAN4			
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			RAN2, RAN4			
		R1-163371	RAN4, RAN2			
			RAN2			
			RAN2, RAN4			

			RAN2, RAN4			
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APPENDIX 23

www.3gpp.org / ftp / tsg_ran / WG1_RL1 / TSGR1_86b / Docs

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Petitioners' Exhibit 1007, p. 1020
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

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AT&T et al v. Asustek Technology & Celerity
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IPR2024-01121

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IPR2024-01121

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Petitioners' Exhibit 1007, p. 1024
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

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IPR2024-01121

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IPR2024-01121

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R1-1608857.zip	2016/10/01 1:21	57,8 KB
R1-1608858.zip	2016/10/01 1:25	133,9 KB
R1-1608859.zip	2016/10/01 1:25	80,3 KB
R1-1608860.zip	2016/10/01 1:25	260,7 KB
R1-1608861.zip	2016/10/01 1:25	179,1 KB
R1-1608862.zip	2016/10/01 4:42	855,7 KB
R1-1608863.zip	2016/10/01 4:42	745,3 KB
R1-1608864.zip	2016/10/01 4:42	862,2 KB
R1-1608865.zip	2016/10/01 4:42	384,5 KB
R1-1608866.zip	2016/10/01 4:42	382,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1608867.zip	2016/10/01 4:42	178,6 KB
R1-1608868.zip	2016/10/01 1:21	243,7 KB
R1-1608869.zip	2016/10/01 1:25	255,9 KB
R1-1608870.zip	2016/10/01 1:25	34,6 KB
R1-1608871.zip	2016/10/01 7:51	849,1 KB
R1-1608872.zip	2016/10/01 7:51	197,5 KB
R1-1608873.zip	2016/10/01 7:51	444,7 KB
R1-1608874.zip	2016/10/01 7:51	385,7 KB
R1-1608875.zip	2016/10/01 7:51	810,4 KB
R1-1608876.zip	2016/10/01 7:51	75,5 KB
R1-1608877.zip	2016/10/01 7:51	342,5 KB
R1-1608878.zip	2016/10/01 7:51	213,8 KB
R1-1608879.zip	2016/10/01 7:51	34,7 KB
R1-1608880.zip	2016/09/30 20:28	80,4 KB
R1-1608881.zip	2016/09/30 20:28	166,8 KB
R1-1608882.zip	2016/09/30 20:28	93,4 KB
R1-1608883.zip	2016/09/30 15:15	33,4 KB
R1-1608884.zip	2016/09/30 15:15	40,4 KB
R1-1608885.zip	2016/09/30 15:16	59,7 KB
R1-1608886.zip	2016/09/30 15:16	31,1 KB
R1-1608887.zip	2016/09/30 15:16	31,6 KB
R1-1608888.zip	2016/09/30 18:03	55,4 KB
R1-1608889.zip	2016/09/30 15:16	33,7 KB
R1-1608890.zip	2016/09/30 15:01	35,8 KB
R1-1608891.zip	2016/09/30 13:23	33,3 KB
R1-1608892.zip	2016/09/30 16:18	128,7 KB
R1-1608893.zip	2016/09/30 15:01	47,6 KB
R1-1608894.zip	2016/09/30 13:23	53,6 KB
R1-1608895.zip	2016/09/30 13:23	54 KB
R1-1608896.zip	2016/10/01 0:51	64,3 KB
R1-1608897.zip	2016/09/30 15:01	61,5 KB
R1-1608898.zip	2016/09/30 15:01	60,2 KB
R1-1608899.zip	2016/09/30 6:32	319 KB
R1-1608900.zip	2016/09/30 4:56	907,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1608901.zip	2016/09/30 4:56	43,2 KB
R1-1608902.zip	2016/09/30 4:56	156,2 KB
R1-1608903.zip	2016/09/30 4:57	43,9 KB
R1-1608904.zip	2016/09/30 4:57	175,9 KB
R1-1608905.zip	2016/09/30 4:57	38,2 KB
R1-1608906.zip	2016/09/30 4:57	16,4 KB
R1-1608907.zip	2016/09/30 4:57	193,4 KB
R1-1608908.zip	2016/09/30 4:57	54,6 KB
R1-1608909.zip	2016/09/30 4:57	42,9 KB
R1-1608910.zip	2016/09/30 4:57	42,6 KB
R1-1608911.zip	2016/09/30 15:10	81,8 KB
R1-1608912.zip	2016/09/30 15:10	74,3 KB
R1-1608913.zip	2016/09/30 15:10	91,3 KB
R1-1608914.zip	2016/09/30 15:11	283,2 KB
R1-1608915.zip	2016/09/30 15:11	322,6 KB
R1-1608916.zip	2016/09/30 15:09	239 KB
R1-1608917.zip	2016/09/30 15:09	99,6 KB
R1-1608918.zip	2016/09/30 15:09	141 KB
R1-1608919.zip	2016/09/30 15:09	135,8 KB
R1-1608920.zip	2016/09/30 15:09	65,4 KB
R1-1608921.zip	2016/09/30 15:09	71,4 KB
R1-1608922.zip	2016/09/30 15:10	2769 KB
R1-1608923.zip	2016/09/30 15:10	79,9 KB
R1-1608924.zip	2016/09/30 15:10	96,8 KB
R1-1608925.zip	2016/09/30 16:38	432 KB
R1-1608926.zip	2016/09/30 20:11	132,8 KB
R1-1608927.zip	2016/09/30 20:11	143,6 KB
R1-1608928.zip	2016/09/30 20:11	330,8 KB
R1-1608929.zip	2016/09/30 20:11	64,2 KB
R1-1608930.zip	2016/09/30 20:11	218,9 KB
R1-1608931.zip	2016/09/30 20:11	49,2 KB
R1-1608932.zip	2016/09/30 20:11	65,9 KB
R1-1608933.zip	2016/09/30 20:11	96,7 KB
R1-1608934.zip	2016/09/30 22:47	72,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1608935.zip	2016/09/30 22:47	233,4 KB
R1-1608936.zip	2016/09/30 22:47	804,5 KB
R1-1608937.zip	2016/09/30 22:47	26,7 KB
R1-1608938.zip	2016/09/30 22:47	105,3 KB
R1-1608939.zip	2016/09/30 22:47	53,3 KB
R1-1608940.zip	2016/09/30 22:47	38,3 KB
R1-1608941.zip	2016/09/30 22:47	38,2 KB
R1-1608942.zip	2016/09/30 22:47	47 KB
R1-1608943.zip	2016/09/30 22:47	37,9 KB
R1-1608944.zip	2016/09/30 22:47	44,5 KB
R1-1608945.zip	2016/09/30 22:47	502,1 KB
R1-1608946.zip	2016/09/30 22:46	17 KB
R1-1608947.zip	2016/09/30 22:46	31,1 KB
R1-1608948.zip	2016/09/30 22:46	32,1 KB
R1-1608949.zip	2016/09/30 22:46	12,4 KB
R1-1608950.zip	2016/09/30 22:46	165,7 KB
R1-1608951.zip	2016/09/30 22:46	181 KB
R1-1608952.zip	2016/10/01 6:08	86,9 KB
R1-1608953.zip	2016/10/01 6:08	114,1 KB
R1-1608954.zip	2016/10/01 6:08	139,1 KB
R1-1608955.zip	2016/10/01 6:08	182 KB
R1-1608956.zip	2016/10/18 20:17	55,9 KB
R1-1608957.zip	2016/10/01 6:04	674,7 KB
R1-1608958.zip	2016/10/01 6:07	117 KB
R1-1608959.zip	2016/10/01 6:07	136,9 KB
R1-1608960.zip	2016/10/01 6:07	109,1 KB
R1-1608961.zip	2016/10/01 6:07	118,1 KB
R1-1608962.zip	2016/10/01 6:06	204 KB
R1-1608963.zip	2016/10/01 6:06	177 KB
R1-1608964.zip	2016/10/01 6:06	125,4 KB
R1-1608965.zip	2016/10/01 6:06	43,7 KB
R1-1608966.zip	2016/10/01 6:06	431,8 KB
R1-1608967.zip	2016/10/01 6:05	126,8 KB
R1-1608968.zip	2016/10/01 6:05	193,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1608969.zip	2016/10/01 6:05	77,5 KB
R1-1608970.zip	2016/10/01 6:05	47,2 KB
R1-1608971.zip	2016/10/01 6:04	415,5 KB
R1-1608972.zip	2016/10/01 6:03	480,4 KB
R1-1608973.zip	2016/10/01 6:03	176 KB
R1-1608974.zip	2016/10/01 6:03	661,1 KB
R1-1608975.zip	2016/10/01 6:02	348,2 KB
R1-1608976.zip	2016/10/01 6:02	310,6 KB
R1-1608977.zip	2016/09/30 15:30	243,6 KB
R1-1608978.zip	2016/10/01 2:29	52,2 KB
R1-1608979.zip	2016/10/01 2:29	24,7 KB
R1-1608980.zip	2016/10/01 2:29	34,3 KB
R1-1608981.zip	2016/10/01 2:29	473,8 KB
R1-1608982.zip	2016/10/01 2:29	288 KB
R1-1608983.zip	2016/10/01 2:29	92,7 KB
R1-1608984.zip	2016/10/01 2:29	160,7 KB
R1-1608985.zip	2016/10/01 2:29	236,5 KB
R1-1608986.zip	2016/10/01 2:29	362,5 KB
R1-1608987.zip	2016/10/01 2:29	51,9 KB
R1-1608988.zip	2016/10/01 2:29	51,1 KB
R1-1608989.zip	2016/10/01 2:29	321 KB
R1-1608990.zip	2016/10/01 2:30	168,1 KB
R1-1608991.zip	2016/10/01 2:30	434 KB
R1-1608992.zip	2016/10/01 2:30	296,5 KB
R1-1608993.zip	2016/10/01 2:30	91,8 KB
R1-1608994.zip	2016/09/30 8:19	49,1 KB
R1-1608995.zip	2016/09/30 8:19	48 KB
R1-1608996.zip	2016/09/30 8:19	53,4 KB
R1-1608997.zip	2016/09/30 8:19	110,4 KB
R1-1608998.zip	2016/09/30 8:19	195,5 KB
R1-1608999.zip	2016/09/30 8:19	51,7 KB
R1-1609000.zip	2016/09/30 8:19	99,9 KB
R1-1609001.zip	2016/09/30 8:19	65,5 KB
R1-1609002.zip	2016/09/30 8:19	343 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609003.zip	2016/09/30 8:20	148,2 KB
R1-1609004.zip	2016/09/30 8:20	87,2 KB
R1-1609005.zip	2016/09/30 8:20	48 KB
R1-1609006.zip	2016/09/30 8:20	95,6 KB
R1-1609007.zip	2016/09/30 8:20	48,7 KB
R1-1609008.zip	2016/09/30 8:20	93,9 KB
R1-1609009.zip	2016/09/30 8:20	124,3 KB
R1-1609010.zip	2016/09/30 22:55	88,6 KB
R1-1609011.zip	2016/09/30 21:46	280 KB
R1-1609012.zip	2016/09/29 17:41	347,9 KB
R1-1609013.zip	2016/09/29 17:41	235,5 KB
R1-1609014.zip	2016/09/29 17:41	212,8 KB
R1-1609015.zip	2016/09/30 10:22	46,5 KB
R1-1609016.zip	2016/09/30 22:55	31,7 KB
R1-1609017.zip	2016/09/30 10:22	71,4 KB
R1-1609018.zip	2016/09/30 10:22	54,1 KB
R1-1609019.zip	2016/09/29 17:40	2112,9 KB
R1-1609020.zip	2016/09/30 10:22	49,7 KB
R1-1609021.zip	2016/09/29 17:40	264,4 KB
R1-1609022.zip	2016/09/30 22:55	71,3 KB
R1-1609023.zip	2016/09/30 8:06	317,3 KB
R1-1609024.zip	2016/09/30 8:07	65,8 KB
R1-1609025.zip	2016/09/30 10:22	48 KB
R1-1609026.zip	2016/09/30 20:30	122,2 KB
R1-1609027.zip	2016/09/29 17:40	182,2 KB
R1-1609028.zip	2016/09/30 20:30	52,1 KB
R1-1609029.zip	2016/09/30 22:20	58,9 KB
R1-1609030.zip	2016/09/30 22:20	49,4 KB
R1-1609031.zip	2016/09/30 22:20	48,5 KB
R1-1609032.zip	2016/09/30 22:20	48,2 KB
R1-1609033.zip	2016/10/01 1:55	186,9 KB
R1-1609034.zip	2016/10/01 1:57	104,1 KB
R1-1609035.zip	2016/10/01 1:57	220 KB
R1-1609036.zip	2016/09/30 9:27	100 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609037.zip	2016/09/30 9:27	76,4 KB
R1-1609038.zip	2016/09/30 9:27	555 KB
R1-1609039.zip	2016/09/30 9:27	96,6 KB
R1-1609040.zip	2016/09/30 9:27	70,4 KB
R1-1609041.zip	2016/09/30 9:27	294,8 KB
R1-1609042.zip	2016/09/30 9:27	55,6 KB
R1-1609044.zip	2016/10/01 1:57	58,6 KB
R1-1609045.zip	2016/09/30 12:11	128,7 KB
R1-1609046.zip	2016/09/30 12:11	34,8 KB
R1-1609047.zip	2016/09/30 22:20	50,2 KB
R1-1609048.zip	2016/09/30 12:11	167,7 KB
R1-1609049.zip	2016/10/01 1:21	26,4 KB
R1-1609050.zip	2016/09/30 8:20	86,5 KB
R1-1609051.zip	2016/09/30 9:27	159 KB
R1-1609053.zip	2016/09/30 9:29	55,7 KB
R1-1609054.zip	2016/09/30 22:55	97,7 KB
R1-1609055.zip	2016/09/30 22:05	53,7 KB
R1-1609056.zip	2016/09/30 22:20	50,4 KB
R1-1609057.zip	2016/10/01 0:38	102,8 KB
R1-1609058.zip	2016/10/01 0:39	107,1 KB
R1-1609059.zip	2016/10/01 15:05	56 KB
R1-1609060.zip	2016/10/01 0:39	174,3 KB
R1-1609061.zip	2016/10/01 2:17	32,8 KB
R1-1609062.zip	2016/10/01 2:17	42 KB
R1-1609063.zip	2016/10/01 5:54	936,9 KB
R1-1609064.zip	2016/10/01 5:27	422,4 KB
R1-1609065.zip	2016/10/01 5:27	356,2 KB
R1-1609066.zip	2016/10/01 5:54	205,9 KB
R1-1609067.zip	2016/10/01 5:27	283,6 KB
R1-1609068.zip	2016/10/01 5:27	177,5 KB
R1-1609069.zip	2016/10/01 5:27	107,2 KB
R1-1609070.zip	2016/10/01 5:27	1549,5 KB
R1-1609071.zip	2016/10/01 5:27	362,4 KB
R1-1609072.zip	2016/10/01 5:28	2646,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609073.zip	2016/10/01 5:54	313,9 KB
R1-1609074.zip	2016/10/01 5:40	54,7 KB
R1-1609075.zip	2016/10/01 5:54	196,4 KB
R1-1609076.zip	2016/10/01 1:13	161,7 KB
R1-1609077.zip	2016/10/01 5:40	139,6 KB
R1-1609078.zip	2016/10/01 1:57	126,5 KB
R1-1609079.zip	2016/09/30 21:46	67,7 KB
R1-1609080.zip	2016/09/30 21:46	46,3 KB
R1-1609081.zip	2016/09/30 12:32	50,4 KB
R1-1609082.zip	2016/09/30 8:52	98,2 KB
R1-1609083.zip	2016/09/30 12:33	51,2 KB
R1-1609084.zip	2016/09/30 20:30	58,2 KB
R1-1609085.zip	2016/09/30 20:30	435,7 KB
R1-1609086.zip	2016/09/30 22:55	36,4 KB
R1-1609087.zip	2016/09/30 20:30	114,5 KB
R1-1609088.zip	2016/09/30 20:30	46,9 KB
R1-1609089.zip	2016/09/29 17:41	161,4 KB
R1-1609090.zip	2016/09/29 17:41	306,5 KB
R1-1609091.zip	2016/09/30 10:21	102,9 KB
R1-1609092.zip	2016/09/30 10:21	216,7 KB
R1-1609093.zip	2016/09/30 10:21	141,1 KB
R1-1609094.zip	2016/09/30 8:50	30,8 KB
R1-1609096.zip	2016/09/30 20:30	48,5 KB
R1-1609097.zip	2016/09/30 22:55	1749,1 KB
R1-1609098.zip	2016/09/30 8:07	203,2 KB
R1-1609099.zip	2016/10/06 11:14	103,4 KB
R1-1609100.zip	2016/09/30 14:33	794,8 KB
R1-1609101.zip	2016/09/30 8:07	173,6 KB
R1-1609102.zip	2016/09/30 8:06	44,3 KB
R1-1609103.zip	2016/10/01 1:13	154 KB
R1-1609104.zip	2016/10/01 1:13	37,3 KB
R1-1609105.zip	2016/09/30 21:46	39,9 KB
R1-1609106.zip	2016/09/30 12:33	110,6 KB
R1-1609107.zip	2016/10/01 3:34	341,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609108.zip	2016/10/01 3:34	194,5 KB
R1-1609109.zip	2016/10/01 3:34	156,8 KB
R1-1609110.zip	2016/10/01 3:34	76,6 KB
R1-1609111.zip	2016/09/30 9:29	317,4 KB
R1-1609112.zip	2016/09/30 9:29	342,8 KB
R1-1609113.zip	2016/09/30 20:30	94,8 KB
R1-1609114.zip	2016/09/30 9:29	50,9 KB
R1-1609115.zip	2016/09/30 10:22	128,7 KB
R1-1609116.zip	2016/10/01 1:21	21,3 KB
R1-1609117.zip	2016/09/30 21:46	35 KB
R1-1609118.zip	2016/09/30 14:33	1144,5 KB
R1-1609119.zip	2016/09/30 14:33	479,2 KB
R1-1609120.zip	2016/09/30 12:11	46,9 KB
R1-1609121.zip	2016/09/30 22:55	310,5 KB
R1-1609123.zip	2016/09/30 12:33	1531,8 KB
R1-1609124.zip	2016/09/30 12:33	275,1 KB
R1-1609125.zip	2016/09/30 21:46	88,4 KB
R1-1609126.zip	2016/09/30 9:57	86,8 KB
R1-1609127.zip	2016/09/30 22:20	53,8 KB
R1-1609128.zip	2016/09/30 22:20	56 KB
R1-1609129.zip	2016/09/30 9:29	94,2 KB
R1-1609130.zip	2016/09/30 22:20	51,1 KB
R1-1609131.zip	2016/09/30 9:29	97,1 KB
R1-1609132.zip	2016/09/30 9:29	89,3 KB
R1-1609133.zip	2016/09/30 22:05	39 KB
R1-1609134.zip	2016/09/30 9:29	96,2 KB
R1-1609135.zip	2016/10/01 1:21	83,2 KB
R1-1609136.zip	2016/09/30 9:30	62,2 KB
R1-1609137.zip	2016/09/30 9:30	53,8 KB
R1-1609138.zip	2016/09/30 22:20	64,2 KB
R1-1609139.zip	2016/09/30 20:31	195,4 KB
R1-1609140.zip	2016/09/30 12:33	20,5 KB
R1-1609141.zip	2016/09/30 3:47	35,9 KB
R1-1609142.zip	2016/09/30 3:47	22,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609143.zip	2016/09/30 3:47	26 KB
R1-1609144.zip	2016/09/30 3:47	31,3 KB
R1-1609145.zip	2016/09/30 3:46	33,7 KB
R1-1609146.zip	2016/09/30 3:46	30,1 KB
R1-1609147.zip	2016/09/30 3:46	30,4 KB
R1-1609148.zip	2016/09/30 3:46	1002,5 KB
R1-1609149.zip	2016/09/30 3:47	885,9 KB
R1-1609150.zip	2016/09/30 3:47	247 KB
R1-1609151.zip	2016/09/30 3:47	66 KB
R1-1609152.zip	2016/09/30 3:47	525,7 KB
R1-1609153.zip	2016/09/30 3:47	47,1 KB
R1-1609154.zip	2016/09/30 3:47	100,3 KB
R1-1609155.zip	2016/09/30 3:47	179,2 KB
R1-1609156.zip	2016/09/30 3:47	155,5 KB
R1-1609157.zip	2016/09/30 3:47	350,8 KB
R1-1609158.zip	2016/09/30 3:47	139,8 KB
R1-1609159.zip	2016/09/30 3:47	43,6 KB
R1-1609160.zip	2016/09/30 19:08	34,2 KB
R1-1609161.zip	2016/09/30 19:09	170,8 KB
R1-1609162.zip	2016/09/30 19:09	123,1 KB
R1-1609163.zip	2016/09/30 19:08	26,9 KB
R1-1609164.zip	2016/09/30 19:08	256,7 KB
R1-1609165.zip	2016/09/30 19:08	38,5 KB
R1-1609166.zip	2016/10/01 2:18	34,5 KB
R1-1609167.zip	2016/09/30 12:33	22,5 KB
R1-1609168.zip	2016/10/01 4:50	30,6 KB
R1-1609169.zip	2016/10/01 4:50	48,8 KB
R1-1609170.zip	2016/10/01 4:50	28,7 KB
R1-1609171.zip	2016/10/01 4:50	26,5 KB
R1-1609172.zip	2016/10/01 4:50	224,8 KB
R1-1609173.zip	2016/10/01 4:50	31 KB
R1-1609174.zip	2016/10/01 4:50	29,2 KB
R1-1609175.zip	2016/10/01 4:50	57,5 KB
R1-1609178.zip	2016/10/01 4:50	128,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609179.zip	2016/10/04 4:56	67,8 KB
R1-1609180.zip	2016/10/01 4:50	54,3 KB
R1-1609181.zip	2016/10/01 4:50	57,5 KB
R1-1609182.zip	2016/10/01 4:50	65,5 KB
R1-1609183.zip	2016/10/01 4:50	37,9 KB
R1-1609184.zip	2016/10/01 4:50	68,2 KB
R1-1609185.zip	2016/10/01 4:50	75,4 KB
R1-1609186.zip	2016/10/01 4:50	37,8 KB
R1-1609187.zip	2016/10/01 4:50	63,1 KB
R1-1609188.zip	2016/10/01 4:50	39,5 KB
R1-1609189.zip	2016/10/01 4:50	68,8 KB
R1-1609190.zip	2016/10/01 4:50	62,4 KB
R1-1609191.zip	2016/10/01 4:50	69,4 KB
R1-1609192.zip	2016/10/01 4:50	37,5 KB
R1-1609193.zip	2016/10/01 4:50	74,2 KB
R1-1609194.zip	2016/10/01 4:50	32,2 KB
R1-1609195.zip	2016/10/01 4:50	118,7 KB
R1-1609196.zip	2016/10/01 4:50	42,3 KB
R1-1609197.zip	2016/10/01 4:50	32,6 KB
R1-1609198.zip	2016/10/01 4:50	153,8 KB
R1-1609199.zip	2016/10/01 4:50	35,5 KB
R1-1609200.zip	2016/10/01 4:50	35,5 KB
R1-1609201.zip	2016/10/01 4:50	65,4 KB
R1-1609202.zip	2016/10/01 4:50	77,7 KB
R1-1609203.zip	2016/10/01 4:50	183,4 KB
R1-1609204.zip	2016/10/01 4:50	34,6 KB
R1-1609205.zip	2016/10/01 4:50	36,7 KB
R1-1609206.zip	2016/10/01 4:50	49,3 KB
R1-1609207.zip	2016/10/01 4:50	151,6 KB
R1-1609208.zip	2016/10/01 4:50	48 KB
R1-1609209.zip	2016/10/01 4:50	36,4 KB
R1-1609210.zip	2016/10/01 4:50	37,7 KB
R1-1609211.zip	2016/10/01 4:50	37,5 KB
R1-1609212.zip	2016/10/01 4:50	64,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609213.zip	2016/10/01 4:50	37,1 KB
R1-1609214.zip	2016/10/01 4:50	70 KB
R1-1609215.zip	2016/10/01 4:50	79,1 KB
R1-1609216.zip	2016/10/01 4:50	288,1 KB
R1-1609217.zip	2016/10/01 4:50	250,4 KB
R1-1609218.zip	2016/10/01 4:50	37,8 KB
R1-1609219.zip	2016/10/01 4:50	73,7 KB
R1-1609220.zip	2016/10/01 4:50	39,9 KB
R1-1609221.zip	2016/10/01 4:50	90,3 KB
R1-1609222.zip	2016/10/01 4:02	118,6 KB
R1-1609223.zip	2016/10/01 4:02	159,5 KB
R1-1609224.zip	2016/10/05 13:24	35,6 KB
R1-1609225.zip	2016/10/01 4:02	84,1 KB
R1-1609226.zip	2016/10/01 4:02	32,1 KB
R1-1609227.zip	2016/10/01 4:02	28,8 KB
R1-1609228.zip	2016/10/01 4:02	27,9 KB
R1-1609229.zip	2016/10/01 4:02	63,5 KB
R1-1609230.zip	2016/10/01 4:02	154,9 KB
R1-1609231.zip	2016/10/01 4:02	305,3 KB
R1-1609232.zip	2016/10/01 4:02	82,5 KB
R1-1609233.zip	2016/10/01 4:02	55,3 KB
R1-1609234.zip	2016/10/01 4:02	120,7 KB
R1-1609235.zip	2016/10/01 4:02	57 KB
R1-1609236.zip	2016/10/01 4:02	430,2 KB
R1-1609237.zip	2016/10/01 4:02	39,4 KB
R1-1609238.zip	2016/10/01 4:02	41,7 KB
R1-1609239.zip	2016/10/01 4:02	506,9 KB
R1-1609240.zip	2016/10/01 4:02	58 KB
R1-1609241.zip	2016/10/01 4:03	231,4 KB
R1-1609242.zip	2016/10/01 4:03	319,3 KB
R1-1609243.zip	2016/10/01 4:03	56,5 KB
R1-1609244.zip	2016/10/01 4:04	2188,4 KB
R1-1609245.zip	2016/10/01 4:04	303,2 KB
R1-1609246.zip	2016/10/01 4:04	115,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609247.zip	2016/10/01 4:04	336,4 KB
R1-1609248.zip	2016/10/01 4:04	599,5 KB
R1-1609249.zip	2016/10/01 4:04	38,7 KB
R1-1609250.zip	2016/10/01 4:04	37,5 KB
R1-1609251.zip	2016/10/01 4:04	75,6 KB
R1-1609252.zip	2016/10/01 4:04	333,8 KB
R1-1609253.zip	2016/10/01 4:04	30,4 KB
R1-1609254.zip	2016/10/01 4:04	38,1 KB
R1-1609255.zip	2016/10/01 4:04	47,7 KB
R1-1609256.zip	2016/10/01 4:04	310,1 KB
R1-1609257.zip	2016/10/01 4:04	25,2 KB
R1-1609258.zip	2016/10/01 4:04	95,9 KB
R1-1609259.zip	2016/10/01 4:04	382,5 KB
R1-1609260.zip	2016/10/07 11:12	980,1 KB
R1-1609261.zip	2016/10/01 4:04	231,8 KB
R1-1609262.zip	2016/10/01 4:04	217,2 KB
R1-1609263.zip	2016/10/06 11:49	27,6 KB
R1-1609264.zip	2016/10/01 4:04	130,3 KB
R1-1609265.zip	2016/10/01 4:04	103 KB
R1-1609266.zip	2016/10/01 4:04	87,2 KB
R1-1609267.zip	2016/10/01 4:04	80,9 KB
R1-1609268.zip	2016/10/01 4:04	116 KB
R1-1609269.zip	2016/10/01 4:04	453,8 KB
R1-1609270.zip	2016/10/01 4:04	106,7 KB
R1-1609271.zip	2016/10/01 4:04	41,9 KB
R1-1609272.zip	2016/10/01 4:04	63,4 KB
R1-1609273.zip	2016/10/01 4:04	43,4 KB
R1-1609274.zip	2016/10/01 4:04	37,9 KB
R1-1609275.zip	2016/10/01 4:04	38,6 KB
R1-1609276.zip	2016/10/01 4:04	41,6 KB
R1-1609277.zip	2016/10/01 4:04	108,9 KB
R1-1609278.zip	2016/10/01 4:04	128,3 KB
R1-1609279.zip	2016/10/01 4:04	36,3 KB
R1-1609280.zip	2016/10/01 4:04	78,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609281.zip	2016/10/01 4:04	173,2 KB
R1-1609282.zip	2016/10/01 4:04	46,5 KB
R1-1609283.zip	2016/10/01 4:04	139,5 KB
R1-1609284.zip	2016/10/01 4:04	50,6 KB
R1-1609285.zip	2016/10/01 4:04	86 KB
R1-1609286.zip	2016/10/01 4:04	137,1 KB
R1-1609287.zip	2016/10/01 4:04	36,3 KB
R1-1609288.zip	2016/10/01 2:18	58,8 KB
R1-1609289.zip	2016/09/30 18:03	28,1 KB
R1-1609290.zip	2016/09/30 23:30	41 KB
R1-1609291.zip	2016/09/30 23:30	146,1 KB
R1-1609292.zip	2016/09/30 23:30	37,5 KB
R1-1609293.zip	2016/09/30 23:30	49 KB
R1-1609294.zip	2016/09/30 23:30	192,1 KB
R1-1609295.zip	2016/09/30 23:30	56 KB
R1-1609296.zip	2016/09/30 23:30	112,8 KB
R1-1609297.zip	2016/09/30 23:31	577,8 KB
R1-1609298.zip	2016/09/30 23:31	109,4 KB
R1-1609299.zip	2016/09/30 23:31	140,5 KB
R1-1609300.zip	2016/09/30 23:31	221,4 KB
R1-1609301.zip	2016/09/30 23:31	392,5 KB
R1-1609302.zip	2016/09/30 23:31	155,9 KB
R1-1609303.zip	2016/09/30 23:31	189,6 KB
R1-1609305.zip	2016/09/30 23:31	43,6 KB
R1-1609306.zip	2016/09/30 23:31	39,6 KB
R1-1609307.zip	2016/09/30 23:31	100,5 KB
R1-1609308.zip	2016/09/30 23:31	169,2 KB
R1-1609309.zip	2016/09/30 23:31	1046,2 KB
R1-1609310.zip	2016/09/30 23:32	478,3 KB
R1-1609311.zip	2016/09/30 23:32	69,4 KB
R1-1609312.zip	2016/09/30 23:32	58,7 KB
R1-1609313.zip	2016/09/29 23:30	29,6 KB
R1-1609314.zip	2016/09/29 23:30	31,9 KB
R1-1609315.zip	2016/09/30 15:05	43,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609316.zip	2016/09/30 15:06	25,5 KB
R1-1609317.zip	2016/09/30 15:06	91,5 KB
R1-1609318.zip	2016/09/30 15:05	19,5 KB
R1-1609319.zip	2016/09/30 15:05	110,9 KB
R1-1609320.zip	2016/09/30 15:05	26 KB
R1-1609321.zip	2016/09/30 15:05	72,4 KB
R1-1609322.zip	2016/09/30 19:35	43,8 KB
R1-1609323.zip	2016/09/30 19:35	195,9 KB
R1-1609324.zip	2016/09/30 19:35	129,5 KB
R1-1609325.zip	2016/09/30 19:35	520,9 KB
R1-1609326.zip	2016/10/01 3:49	138 KB
R1-1609328.zip	2016/10/01 3:49	33,5 KB
R1-1609329.zip	2016/10/01 3:49	728,6 KB
R1-1609330.zip	2016/10/01 3:49	382,8 KB
R1-1609332.zip	2016/10/01 3:49	559,1 KB
R1-1609333.zip	2016/10/01 3:48	560,6 KB
R1-1609334.zip	2016/10/01 4:05	134,3 KB
R1-1609335.zip	2016/10/01 4:05	133,6 KB
R1-1609336.zip	2016/10/01 3:48	173,1 KB
R1-1609337.zip	2016/10/01 3:48	179,8 KB
R1-1609338.zip	2016/10/01 3:48	379,1 KB
R1-1609339.zip	2016/10/01 1:04	70,4 KB
R1-1609340.zip	2016/10/01 1:04	207,8 KB
R1-1609341.zip	2016/10/01 1:04	148,5 KB
R1-1609342.zip	2016/10/01 1:04	247,4 KB
R1-1609343.zip	2016/10/01 1:04	611,1 KB
R1-1609344.zip	2016/10/01 0:52	60,4 KB
R1-1609345.zip	2016/10/01 0:52	139,5 KB
R1-1609346.zip	2016/10/01 0:52	343,9 KB
R1-1609347.zip	2016/10/01 0:52	229,3 KB
R1-1609348.zip	2016/10/01 0:47	33 KB
R1-1609349.zip	2016/10/01 0:47	466,2 KB
R1-1609350.zip	2016/10/01 0:47	35,3 KB
R1-1609351.zip	2016/10/01 0:47	63,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609352.zip	2016/10/01 0:47	106,9 KB
R1-1609353.zip	2016/10/01 0:47	59,3 KB
R1-1609354.zip	2016/10/01 0:47	29,4 KB
R1-1609355.zip	2016/10/01 0:47	98,7 KB
R1-1609356.zip	2016/10/01 0:47	40,8 KB
R1-1609357.zip	2016/10/01 0:52	32,8 KB
R1-1609358.zip	2016/10/01 0:52	136,7 KB
R1-1609359.zip	2016/10/01 0:52	46,3 KB
R1-1609360.zip	2016/10/01 0:52	230,4 KB
R1-1609361.zip	2016/10/01 0:52	97,8 KB
R1-1609362.zip	2016/10/01 0:52	103,6 KB
R1-1609363.zip	2016/10/01 0:52	89,2 KB
R1-1609364.zip	2016/10/01 0:52	255 KB
R1-1609365.zip	2016/10/01 0:52	177,8 KB
R1-1609366.zip	2016/10/01 0:47	32,8 KB
R1-1609367.zip	2016/10/01 0:47	23,5 KB
R1-1609368.zip	2016/10/01 0:47	29,3 KB
R1-1609369.zip	2016/10/01 0:52	102,8 KB
R1-1609370.zip	2016/10/01 0:52	54,8 KB
R1-1609371.zip	2016/10/01 0:52	41,8 KB
R1-1609372.zip	2016/10/01 0:52	97,4 KB
R1-1609373.zip	2016/10/01 0:52	121,7 KB
R1-1609374.zip	2016/10/01 1:04	205,7 KB
R1-1609375.zip	2016/10/01 1:04	42,5 KB
R1-1609376.zip	2016/10/01 1:04	183,6 KB
R1-1609377.zip	2016/09/30 20:28	41,3 KB
R1-1609378.zip	2016/10/01 3:48	318,1 KB
R1-1609379.zip	2016/09/30 22:46	351,3 KB
R1-1609380.zip	2016/09/30 22:47	581,5 KB
R1-1609381.zip	2016/09/30 22:47	36,5 KB
R1-1609382.zip	2016/10/01 6:01	109,8 KB
R1-1609383.zip	2016/10/03 11:44	298,4 KB
R1-1609384.zip	2016/10/01 2:31	13,4 KB
R1-1609385.zip	2016/10/01 2:32	289,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609386.zip	2016/10/01 2:32	68,4 KB
R1-1609387.zip	2016/10/01 2:32	301 KB
R1-1609388.zip	2016/10/01 2:32	114,9 KB
R1-1609389.zip	2016/09/30 3:47	81,6 KB
R1-1609390.zip	2016/09/29 1:09	415,9 KB
R1-1609391.zip	2016/10/01 2:20	97,3 KB
R1-1609392.zip	2016/10/01 2:20	68,2 KB
R1-1609393.zip	2016/10/01 2:20	347,5 KB
R1-1609394.zip	2016/10/01 2:20	178,9 KB
R1-1609395.zip	2016/10/01 0:27	337,7 KB
R1-1609396.zip	2016/10/01 0:27	102 KB
R1-1609397.zip	2016/10/01 0:27	73,4 KB
R1-1609398.zip	2016/10/01 0:27	109,6 KB
R1-1609399.zip	2016/10/01 0:27	45,8 KB
R1-1609400.zip	2016/10/01 0:27	42,2 KB
R1-1609401.zip	2016/10/01 0:27	68,8 KB
R1-1609402.zip	2016/10/01 0:27	70 KB
R1-1609403.zip	2016/09/30 7:22	20,9 KB
R1-1609404.zip	2016/09/30 7:22	21 KB
R1-1609405.zip	2016/09/30 7:22	168,2 KB
R1-1609406.zip	2016/09/30 7:22	122,5 KB
R1-1609407.zip	2016/09/30 7:22	39,8 KB
R1-1609408.zip	2016/10/01 1:21	146,2 KB
R1-1609409.zip	2016/09/30 7:22	341 KB
R1-1609410.zip	2016/09/30 7:22	29,6 KB
R1-1609411.zip	2016/09/30 7:22	224,4 KB
R1-1609412.zip	2016/09/30 7:22	49,4 KB
R1-1609413.zip	2016/10/01 1:21	271,4 KB
R1-1609414.zip	2016/10/01 1:21	390,7 KB
R1-1609415.zip	2016/10/01 1:21	92,7 KB
R1-1609416.zip	2016/10/01 1:21	218,8 KB
R1-1609417.zip	2016/10/01 1:21	107,4 KB
R1-1609418.zip	2016/10/01 1:21	33,7 KB
R1-1609419.zip	2016/10/01 1:21	203,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609420.zip	2016/10/01 1:21	240,3 KB
R1-1609421.zip	2016/10/01 1:21	421,1 KB
R1-1609422.zip	2016/10/01 1:21	275,5 KB
R1-1609423.zip	2016/10/01 1:21	165,5 KB
R1-1609424.zip	2016/10/01 1:21	212,7 KB
R1-1609425.zip	2016/10/01 1:21	34,4 KB
R1-1609426.zip	2016/10/01 1:21	146,8 KB
R1-1609427.zip	2016/10/01 1:21	255,6 KB
R1-1609428.zip	2016/10/01 1:21	299,2 KB
R1-1609429.zip	2016/10/01 1:21	132,3 KB
R1-1609430.zip	2016/10/01 1:21	178 KB
R1-1609431.zip	2016/10/01 1:21	30,2 KB
R1-1609432.zip	2016/10/01 1:21	77,8 KB
R1-1609433.zip	2016/10/01 1:21	90,6 KB
R1-1609434.zip	2016/10/01 1:21	75,4 KB
R1-1609435.zip	2016/10/01 1:21	131,7 KB
R1-1609436.zip	2016/10/01 1:21	261,2 KB
R1-1609437.zip	2016/10/01 1:21	45,9 KB
R1-1609438.zip	2016/10/01 1:21	870,9 KB
R1-1609439.zip	2016/10/03 2:52	438,8 KB
R1-1609440.zip	2016/10/01 0:47	60,1 KB
R1-1609441.zip	2016/10/01 1:25	99,8 KB
R1-1609442.zip	2016/10/01 1:25	127,6 KB
R1-1609443.zip	2016/10/01 1:25	166,3 KB
R1-1609445.zip	2016/10/01 1:21	31,5 KB
R1-1609446.zip	2016/10/01 1:25	96 KB
R1-1609447.zip	2016/10/01 1:25	213 KB
R1-1609448.zip	2016/10/01 1:21	436,6 KB
R1-1609449.zip	2016/10/04 3:24	29,6 KB
R1-1609450.zip	2016/10/04 3:24	25,6 KB
R1-1609451.zip	2016/10/04 3:24	56 KB
R1-1609452.zip	2016/10/04 3:24	65,3 KB
R1-1609453.zip	2016/10/01 6:17	64,7 KB
R1-1609454.zip	2016/10/01 6:17	61,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609455.zip	2016/10/01 6:17	55,5 KB
R1-1609456.zip	2016/10/01 6:17	53,6 KB
R1-1609457.zip	2016/10/01 6:17	392,7 KB
R1-1609458.zip	2016/10/01 6:18	906,9 KB
R1-1609459.zip	2016/10/01 6:18	60,7 KB
R1-1609460.zip	2016/10/01 6:18	57,4 KB
R1-1609461.zip	2016/10/01 6:18	262,9 KB
R1-1609462.zip	2016/10/01 6:18	55,6 KB
R1-1609463.zip	2016/10/01 6:18	218,5 KB
R1-1609464.zip	2016/10/01 6:18	85,1 KB
R1-1609465.zip	2016/10/01 6:18	217,9 KB
R1-1609466.zip	2016/10/01 6:18	78,2 KB
R1-1609467.zip	2016/10/01 6:18	93,1 KB
R1-1609468.zip	2016/10/01 6:18	64,3 KB
R1-1609469.zip	2016/10/01 6:18	87 KB
R1-1609470.zip	2016/10/01 6:18	52,5 KB
R1-1609471.zip	2016/10/01 6:18	52,2 KB
R1-1609472.zip	2016/10/01 6:18	90,2 KB
R1-1609473.zip	2016/10/01 6:18	177 KB
R1-1609474.zip	2016/10/01 6:18	134,9 KB
R1-1609475.zip	2016/10/01 6:18	320,4 KB
R1-1609476.zip	2016/10/01 9:37	57,4 KB
R1-1609477.zip	2016/10/01 8:43	1251,8 KB
R1-1609478.zip	2016/10/01 9:24	63 KB
R1-1609479.zip	2016/10/01 8:44	53,5 KB
R1-1609480.zip	2016/10/01 7:21	4284,8 KB
R1-1609481.zip	2016/10/01 8:44	54 KB
R1-1609482.zip	2016/10/01 8:44	54,9 KB
R1-1609484.zip	2016/10/01 6:18	111,6 KB
R1-1609485.zip	2016/10/01 6:18	185,8 KB
R1-1609486.zip	2016/10/01 6:18	406,7 KB
R1-1609487.zip	2016/10/01 6:18	205,8 KB
R1-1609488.zip	2016/10/01 6:18	259,4 KB
R1-1609489.zip	2016/10/01 6:18	68,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609490.zip	2016/10/01 6:18	39,8 KB
R1-1609491.zip	2016/10/01 6:18	175,1 KB
R1-1609492.zip	2016/10/01 6:18	442,6 KB
R1-1609493.zip	2016/10/01 6:18	1286,2 KB
R1-1609494.zip	2016/10/01 6:19	442,8 KB
R1-1609495.zip	2016/10/01 6:19	17,4 KB
R1-1609496.zip	2016/10/01 6:19	84,5 KB
R1-1609497.zip	2016/10/01 7:04	403,5 KB
R1-1609498.zip	2016/10/01 7:04	62,8 KB
R1-1609499.zip	2016/10/01 7:21	130,1 KB
R1-1609500.zip	2016/10/01 7:05	385,6 KB
R1-1609501.zip	2016/10/01 7:05	220,8 KB
R1-1609502.zip	2016/10/01 7:22	86,1 KB
R1-1609503.zip	2016/10/01 6:19	113,4 KB
R1-1609504.zip	2016/10/01 8:54	146,1 KB
R1-1609505.zip	2016/10/01 6:19	53,1 KB
R1-1609506.zip	2016/10/01 6:31	230,1 KB
R1-1609507.zip	2016/10/01 6:31	53,9 KB
R1-1609508.zip	2016/10/01 6:31	151,2 KB
R1-1609509.zip	2016/10/01 6:31	78,9 KB
R1-1609510.zip	2016/10/01 6:19	303,8 KB
R1-1609511.zip	2016/10/01 6:19	20,6 KB
R1-1609512.zip	2016/10/01 6:19	78,4 KB
R1-1609513.zip	2016/10/01 6:19	251,5 KB
R1-1609514.zip	2016/10/01 6:19	152,6 KB
R1-1609515.zip	2016/10/01 6:19	1120,5 KB
R1-1609516.zip	2016/10/01 6:19	936,4 KB
R1-1609517.zip	2016/10/01 6:19	183,6 KB
R1-1609518.zip	2016/10/01 6:19	701,6 KB
R1-1609519.zip	2016/10/01 6:19	271 KB
R1-1609520.zip	2016/10/01 6:19	99,7 KB
R1-1609521.zip	2016/10/01 6:19	1288,9 KB
R1-1609522.zip	2016/10/01 6:19	259,1 KB
R1-1609523.zip	2016/10/01 6:19	923,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609524.zip	2016/10/01 6:19	130,5 KB
R1-1609525.zip	2016/10/01 6:19	170,9 KB
R1-1609526.zip	2016/10/01 6:17	70,9 KB
R1-1609527.zip	2016/10/01 6:17	158,9 KB
R1-1609528.zip	2016/10/01 6:17	85,5 KB
R1-1609529.zip	2016/10/01 6:17	174,9 KB
R1-1609530.zip	2016/10/01 6:17	158,4 KB
R1-1609531.zip	2016/10/01 6:17	135,4 KB
R1-1609532.zip	2016/10/01 6:17	678,9 KB
R1-1609533.zip	2016/10/01 6:31	298,8 KB
R1-1609534.zip	2016/10/01 6:17	113,8 KB
R1-1609535.zip	2016/10/01 6:17	50,4 KB
R1-1609536.zip	2016/10/01 6:17	193,4 KB
R1-1609537.zip	2016/10/01 6:17	168 KB
R1-1609538.zip	2016/10/01 6:17	101,5 KB
R1-1609539.zip	2016/10/01 6:31	87,2 KB
R1-1609540.zip	2016/10/01 6:31	60,4 KB
R1-1609541.zip	2016/10/01 6:31	60,1 KB
R1-1609542.zip	2016/10/01 6:31	98 KB
R1-1609543.zip	2016/10/01 6:17	184,6 KB
R1-1609544.zip	2016/10/01 6:31	55,5 KB
R1-1609545.zip	2016/10/01 6:17	55,5 KB
R1-1609546.zip	2016/10/01 6:17	228,3 KB
R1-1609547.zip	2016/09/30 15:07	69,5 KB
R1-1609548.zip	2016/10/01 1:29	218,9 KB
R1-1609549.zip	2016/10/01 1:29	69,6 KB
R1-1609550.zip	2016/10/01 3:48	476,1 KB
R1-1609552.zip	2016/10/01 4:25	20,3 KB
R1-1609553.zip	2016/10/01 2:00	46,4 KB
R1-1609554.zip	2016/10/01 3:48	127,8 KB
R1-1609555.zip	2016/10/01 3:48	93,6 KB
R1-1609556.zip	2016/10/01 3:48	245,5 KB
R1-1609557.zip	2016/10/01 3:47	464,8 KB
R1-1609558.zip	2016/10/01 3:45	471,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609559.zip	2016/10/01 3:44	1913,1 KB
R1-1609560.zip	2016/10/01 3:43	136,6 KB
R1-1609561.zip	2016/10/01 3:43	105,4 KB
R1-1609562.zip	2016/10/01 5:52	161,5 KB
R1-1609563.zip	2016/10/01 3:43	155,1 KB
R1-1609564.zip	2016/09/30 16:09	442,6 KB
R1-1609565.zip	2016/09/30 1:08	52,9 KB
R1-1609566.zip	2016/09/30 1:08	35,7 KB
R1-1609567.zip	2016/09/30 16:09	811,5 KB
R1-1609568.zip	2016/09/30 16:09	966,6 KB
R1-1609569.zip	2016/09/30 15:05	28,9 KB
R1-1609570.zip	2016/09/30 12:55	109,9 KB
R1-1609571.zip	2016/09/30 12:55	74,7 KB
R1-1609572.zip	2016/09/30 12:55	173,5 KB
R1-1609573.zip	2016/09/30 12:55	112,7 KB
R1-1609574.zip	2016/09/30 12:55	67,6 KB
R1-1609575.zip	2016/09/30 12:55	111,3 KB
R1-1609576.zip	2016/10/04 0:40	33,9 KB
R1-1609577.zip	2016/10/04 0:40	32,8 KB
R1-1609578.zip	2016/09/30 7:57	39,9 KB
R1-1609579.zip	2016/09/30 7:57	83,9 KB
R1-1609580.zip	2016/09/30 7:57	38,6 KB
R1-1609581.zip	2016/09/30 7:57	45,4 KB
R1-1609582.zip	2016/09/30 19:57	77,2 KB
R1-1609583.zip	2016/09/30 19:57	1896,7 KB
R1-1609584.zip	2016/09/30 19:57	271,3 KB
R1-1609585.zip	2016/09/30 19:57	313 KB
R1-1609586.zip	2016/09/30 19:57	52,3 KB
R1-1609587.zip	2016/09/30 19:58	2098,3 KB
R1-1609588.zip	2016/09/30 19:55	127,9 KB
R1-1609589.zip	2016/09/30 19:55	1700,8 KB
R1-1609590.zip	2016/09/30 19:56	500,3 KB
R1-1609591.zip	2016/09/30 19:56	332,7 KB
R1-1609592.zip	2016/09/30 19:56	110,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609593.zip	2016/09/30 19:56	93,9 KB
R1-1609594.zip	2016/09/30 19:57	2459,2 KB
R1-1609595.zip	2016/09/30 13:52	63,5 KB
R1-1609596.zip	2016/09/30 14:43	227,6 KB
R1-1609597.zip	2016/09/30 14:43	88,3 KB
R1-1609598.zip	2016/09/30 14:43	264,8 KB
R1-1609599.zip	2016/09/30 18:26	276,1 KB
R1-1609600.zip	2016/09/30 11:59	22,8 KB
R1-1609601.zip	2016/09/30 11:59	20,4 KB
R1-1609602.zip	2016/09/30 11:59	29,9 KB
R1-1609603.zip	2016/09/30 11:59	21,8 KB
R1-1609604.zip	2016/09/30 11:59	36,6 KB
R1-1609605.zip	2016/09/30 16:47	50,6 KB
R1-1609606.zip	2016/09/30 15:05	29,2 KB
R1-1609607.zip	2016/10/01 2:20	1019,7 KB
R1-1609608.zip	2016/10/01 2:20	234,3 KB
R1-1609609.zip	2016/10/01 2:20	309,6 KB
R1-1609611.zip	2016/10/01 2:20	94,8 KB
R1-1609612.zip	2016/10/01 3:42	56,6 KB
R1-1609613.zip	2016/10/01 3:42	69,2 KB
R1-1609614.zip	2016/10/01 3:42	48,8 KB
R1-1609615.zip	2016/09/30 19:21	794,3 KB
R1-1609616.zip	2016/09/30 19:22	565,8 KB
R1-1609617.zip	2016/09/30 19:22	113,3 KB
R1-1609618.zip	2016/09/30 19:55	45,4 KB
R1-1609619.zip	2016/09/30 19:55	20,2 KB
R1-1609620.zip	2016/09/30 19:55	19,6 KB
R1-1609621.zip	2016/09/30 19:55	20,4 KB
R1-1609622.zip	2016/09/30 19:55	48,5 KB
R1-1609623.zip	2016/09/30 19:55	71,7 KB
R1-1609624.zip	2016/09/30 19:55	45 KB
R1-1609625.zip	2016/09/30 19:55	48,1 KB
R1-1609626.zip	2016/09/30 19:55	18,1 KB
R1-1609627.zip	2016/09/30 19:55	19,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609628.zip	2016/09/30 19:55	27,8 KB
R1-1609629.zip	2016/09/30 19:55	49,3 KB
R1-1609630.zip	2016/09/30 19:55	20,2 KB
R1-1609631.zip	2016/09/30 19:56	33,2 KB
R1-1609632.zip	2016/09/30 19:56	17,8 KB
R1-1609633.zip	2016/09/30 19:56	38,8 KB
R1-1609634.zip	2016/09/30 19:56	82,7 KB
R1-1609635.zip	2016/09/30 19:56	77,3 KB
R1-1609636.zip	2016/09/30 19:56	157,4 KB
R1-1609637.zip	2016/09/30 19:56	58,2 KB
R1-1609638.zip	2016/09/30 19:56	58,9 KB
R1-1609639.zip	2016/09/30 19:56	58,1 KB
R1-1609640.zip	2016/09/30 19:56	59,3 KB
R1-1609641.zip	2016/09/30 19:56	59,4 KB
R1-1609642.zip	2016/09/30 19:56	21 KB
R1-1609644.zip	2016/09/30 19:56	29,6 KB
R1-1609645.zip	2016/09/30 19:56	21,1 KB
R1-1609646.zip	2016/09/30 14:43	36,7 KB
R1-1609647.zip	2016/09/30 17:20	95,1 KB
R1-1609648.zip	2016/09/30 14:43	136,2 KB
R1-1609649.zip	2016/09/30 15:01	207 KB
R1-1609650.zip	2016/09/30 14:43	187,5 KB
R1-1609651.zip	2016/09/30 14:47	190,2 KB
R1-1609652.zip	2016/09/30 14:48	136,7 KB
R1-1609653.zip	2016/09/30 15:01	250 KB
R1-1609654.zip	2016/09/30 14:43	36,3 KB
R1-1609655.zip	2016/09/30 14:43	32 KB
R1-1609656.zip	2016/09/30 15:25	151,1 KB
R1-1609657.zip	2016/09/30 15:25	67,8 KB
R1-1609658.zip	2016/09/30 15:25	36,3 KB
R1-1609659.zip	2016/09/30 15:25	170,7 KB
R1-1609660.zip	2016/09/30 15:11	179,3 KB
R1-1609661.zip	2016/09/30 15:25	125,3 KB
R1-1609662.zip	2016/09/30 15:25	67,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609663.zip	2016/09/30 15:25	76,7 KB
R1-1609664.zip	2016/09/30 15:25	203,6 KB
R1-1609665.zip	2016/09/30 19:43	44,3 KB
R1-1609666.zip	2016/09/30 15:25	60,6 KB
R1-1609667.zip	2016/09/30 19:43	74 KB
R1-1609668.zip	2016/10/01 5:43	71,8 KB
R1-1609669.zip	2016/10/01 5:43	43 KB
R1-1609670.zip	2016/10/01 5:43	586,3 KB
R1-1609671.zip	2016/10/01 5:43	710,7 KB
R1-1609672.zip	2016/10/01 5:43	541,7 KB
R1-1609673.zip	2016/10/01 5:43	330,2 KB
R1-1609674.zip	2016/10/01 5:43	49,1 KB
R1-1609675.zip	2016/10/01 5:43	211,3 KB
R1-1609676.zip	2016/09/30 22:07	24,3 KB
R1-1609677.zip	2016/09/30 22:07	30,6 KB
R1-1609678.zip	2016/09/30 22:07	21,3 KB
R1-1609679.zip	2016/09/30 18:03	36,5 KB
R1-1609680.zip	2016/09/30 18:03	76 KB
R1-1609681.zip	2016/09/30 15:20	101,2 KB
R1-1609682.zip	2016/09/30 15:20	31,2 KB
R1-1609683.zip	2016/09/30 19:37	29 KB
R1-1609684.zip	2016/09/30 19:37	44,1 KB
R1-1609685.zip	2016/09/30 19:38	28,3 KB
R1-1609686.zip	2016/09/30 19:38	299,1 KB
R1-1609687.zip	2016/09/30 19:39	32,9 KB
R1-1609688.zip	2016/09/30 19:39	74,7 KB
R1-1609689.zip	2016/09/30 19:52	35,2 KB
R1-1609690.zip	2016/09/30 15:20	26,6 KB
R1-1609691.zip	2016/09/30 15:20	34,5 KB
R1-1609692.zip	2016/09/30 15:20	38,5 KB
R1-1609693.zip	2016/09/30 15:20	28 KB
R1-1609694.zip	2016/09/30 15:20	28,2 KB
R1-1609695.zip	2016/09/30 15:20	27,9 KB
R1-1609697.zip	2016/09/30 15:20	28,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609698.zip	2016/09/30 13:33	68,1 KB
R1-1609699.zip	2016/09/30 22:30	109,1 KB
R1-1609700.zip	2016/09/30 13:29	100,6 KB
R1-1609701.zip	2016/09/30 13:22	68,6 KB
R1-1609702.zip	2016/09/30 13:20	64,6 KB
R1-1609703.zip	2016/09/30 22:30	182,1 KB
R1-1609704.zip	2016/09/30 13:15	106,8 KB
R1-1609705.zip	2016/09/30 13:14	84,1 KB
R1-1609706.zip	2016/09/30 13:06	89,3 KB
R1-1609707.zip	2016/09/30 22:30	79,3 KB
R1-1609708.zip	2016/09/29 16:22	933 KB
R1-1609709.zip	2016/09/30 22:30	169,1 KB
R1-1609710.zip	2016/09/30 22:30	47,7 KB
R1-1609711.zip	2016/09/30 22:30	183,1 KB
R1-1609712.zip	2016/09/30 22:30	72,7 KB
R1-1609713.zip	2016/09/30 22:30	68,5 KB
R1-1609714.zip	2016/09/30 22:30	274,9 KB
R1-1609715.zip	2016/10/01 9:03	397,2 KB
R1-1609716.zip	2016/10/01 9:43	119,4 KB
R1-1609717.zip	2016/09/30 22:30	102,4 KB
R1-1609718.zip	2016/09/30 22:30	62,6 KB
R1-1609719.zip	2016/09/30 22:30	65,1 KB
R1-1609720.zip	2016/09/30 22:30	87,3 KB
R1-1609721.zip	2016/09/30 22:30	61,8 KB
R1-1609722.zip	2016/09/30 19:31	138,1 KB
R1-1609723.zip	2016/09/30 17:01	35,6 KB
R1-1609724.zip	2016/09/30 22:29	325,6 KB
R1-1609725.zip	2016/09/30 19:31	600,7 KB
R1-1609726.zip	2016/09/30 22:30	189,5 KB
R1-1609727.zip	2016/09/30 22:34	63,7 KB
R1-1609729.zip	2016/09/30 22:30	62,3 KB
R1-1609730.zip	2016/09/30 22:30	65,3 KB
R1-1609731.zip	2016/09/30 22:30	61,7 KB
R1-1609732.zip	2016/09/30 22:30	67 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609733.zip	2016/09/30 22:30	79,9 KB
R1-1609734.zip	2016/09/30 22:33	185,5 KB
R1-1609735.zip	2016/10/01 1:48	335,3 KB
R1-1609736.zip	2016/10/01 1:48	956,6 KB
R1-1609737.zip	2016/10/01 1:48	36,4 KB
R1-1609738.zip	2016/10/01 1:48	206,7 KB
R1-1609739.zip	2016/10/01 1:47	88,7 KB
R1-1609740.zip	2016/10/01 1:47	103,4 KB
R1-1609741.zip	2016/10/01 1:47	124,8 KB
R1-1609742.zip	2016/10/01 1:47	138,6 KB
R1-1609743.zip	2016/10/01 1:47	115,2 KB
R1-1609744.zip	2016/10/01 1:47	106,3 KB
R1-1609745.zip	2016/10/01 1:47	113 KB
R1-1609746.zip	2016/10/01 1:47	281,5 KB
R1-1609747.zip	2016/10/01 1:47	92,3 KB
R1-1609748.zip	2016/10/01 1:47	84,1 KB
R1-1609749.zip	2016/10/01 1:47	60,8 KB
R1-1609751.zip	2016/09/30 22:30	59,7 KB
R1-1609752.zip	2016/09/30 22:30	73,9 KB
R1-1609753.zip	2016/09/30 22:30	319,6 KB
R1-1609754.zip	2016/09/30 20:15	53,3 KB
R1-1609755.zip	2016/09/30 20:15	33,6 KB
R1-1609756.zip	2016/09/30 20:15	27,7 KB
R1-1609758.zip	2016/09/30 20:15	100,7 KB
R1-1609760.zip	2016/09/30 20:15	34,2 KB
R1-1609761.zip	2016/09/30 20:15	54,6 KB
R1-1609762.zip	2016/09/30 20:15	110,6 KB
R1-1609763.zip	2016/09/30 20:15	81,3 KB
R1-1609764.zip	2016/09/30 20:15	31,8 KB
R1-1609765.zip	2016/09/30 20:27	84,9 KB
R1-1609766.zip	2016/09/30 20:27	60,5 KB
R1-1609767.zip	2016/09/30 20:23	73,9 KB
R1-1609768.zip	2016/09/30 20:23	86,5 KB
R1-1609769.zip	2016/09/30 20:23	263,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609770.zip	2016/09/30 20:23	258,5 KB
R1-1609771.zip	2016/09/30 20:23	109,6 KB
R1-1609772.zip	2016/09/30 20:23	76,7 KB
R1-1609773.zip	2016/09/30 20:23	44,3 KB
R1-1609774.zip	2016/09/30 20:23	23,9 KB
R1-1609775.zip	2016/09/30 20:23	41,5 KB
R1-1609776.zip	2016/09/30 13:32	39,4 KB
R1-1609777.zip	2016/10/03 18:37	48,8 KB
R1-1609778.zip	2016/10/01 2:44	169,4 KB
R1-1609779.zip	2016/10/01 2:44	221,9 KB
R1-1609780.zip	2016/10/01 2:44	77,5 KB
R1-1609781.zip	2016/09/30 20:50	22,1 KB
R1-1609782.zip	2016/10/01 4:15	24,5 KB
R1-1609783.zip	2016/09/30 15:01	336,4 KB
R1-1609784.zip	2016/10/01 4:15	25,1 KB
R1-1609785.zip	2016/10/18 20:17	2210,3 KB
R1-1609786.zip	2016/10/01 0:19	50,2 KB
R1-1609787.zip	2016/10/01 0:19	78,8 KB
R1-1609788.zip	2016/10/01 0:19	69,7 KB
R1-1609789.zip	2016/10/01 0:19	23,8 KB
R1-1609790.zip	2016/10/01 0:19	50,9 KB
R1-1609791.zip	2016/09/30 13:11	81,3 KB
R1-1609792.zip	2016/09/30 21:34	149,9 KB
R1-1609793.zip	2016/09/30 17:54	138,7 KB
R1-1609794.zip	2016/09/30 17:54	112,2 KB
R1-1609795.zip	2016/09/30 17:54	355,6 KB
R1-1609796.zip	2016/09/30 17:54	42,7 KB
R1-1609797.zip	2016/09/30 17:54	31,6 KB
R1-1609798.zip	2016/09/30 17:54	23,3 KB
R1-1609799.zip	2016/09/30 17:54	184,9 KB
R1-1609800.zip	2016/09/30 17:16	284,7 KB
R1-1609801.zip	2016/09/30 17:16	115,2 KB
R1-1609802.zip	2016/09/30 17:16	626,4 KB
R1-1609803.zip	2016/09/30 17:16	104,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609804.zip	2016/09/30 17:24	28,9 KB
R1-1609805.zip	2016/09/30 17:24	51,2 KB
R1-1609806.zip	2016/09/30 17:24	54,7 KB
R1-1609807.zip	2016/09/30 17:24	148,8 KB
R1-1609808.zip	2016/09/30 17:24	29,2 KB
R1-1609809.zip	2016/09/30 17:24	180,9 KB
R1-1609810.zip	2016/09/30 17:24	100,7 KB
R1-1609811.zip	2016/09/30 17:24	41,1 KB
R1-1609812.zip	2016/09/30 17:24	56,1 KB
R1-1609813.zip	2016/09/30 12:19	136,3 KB
R1-1609814.zip	2016/09/30 12:19	66,6 KB
R1-1609815.zip	2016/09/30 12:19	251,6 KB
R1-1609816.zip	2016/09/30 12:19	67,6 KB
R1-1609817.zip	2016/09/30 17:24	38,9 KB
R1-1609818.zip	2016/10/01 0:56	103,5 KB
R1-1609819.zip	2016/10/01 0:56	71,9 KB
R1-1609820.zip	2016/10/01 0:35	129,2 KB
R1-1609821.zip	2016/10/01 0:35	53,2 KB
R1-1609822.zip	2016/10/01 0:35	301,1 KB
R1-1609823.zip	2016/10/01 0:35	725,7 KB
R1-1609824.zip	2016/10/01 1:27	28,1 KB
R1-1609825.zip	2016/10/01 3:40	219,9 KB
R1-1609826.zip	2016/10/01 0:12	32,8 KB
R1-1609827.zip	2016/10/01 0:12	46,5 KB
R1-1609828.zip	2016/10/01 0:12	405,6 KB
R1-1609829.zip	2016/10/01 0:12	208,7 KB
R1-1609830.zip	2016/10/01 0:12	234,5 KB
R1-1609831.zip	2016/10/01 0:12	96,3 KB
R1-1609832.zip	2016/10/01 0:12	61,4 KB
R1-1609833.zip	2016/10/01 0:12	54,7 KB
R1-1609834.zip	2016/10/01 0:12	345,3 KB
R1-1609835.zip	2016/10/01 4:49	344,4 KB
R1-1609836.zip	2016/10/01 4:49	267,7 KB
R1-1609837.zip	2016/10/01 4:49	83,1 KB

Petitioners' Exhibit 1007, p. 1056
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609838.zip	2016/10/01 4:49	50,2 KB
R1-1609839.zip	2016/10/01 4:49	74,7 KB
R1-1609840.zip	2016/10/01 5:59	117,9 KB
R1-1609841.zip	2016/10/01 5:59	146,6 KB
R1-1609842.zip	2016/10/01 5:59	34,1 KB
R1-1609843.zip	2016/10/01 5:59	242,4 KB
R1-1609844.zip	2016/10/01 6:14	58,4 KB
R1-1609845.zip	2016/10/01 6:32	40,1 KB
R1-1609846.zip	2016/10/01 6:45	94,2 KB
R1-1609847.zip	2016/10/01 6:15	72,1 KB
R1-1609848.zip	2016/10/01 6:30	91,7 KB
R1-1609849.zip	2016/10/01 6:47	72 KB
R1-1609850.zip	2016/10/01 6:30	95,8 KB
R1-1609851.zip	2016/10/01 5:59	104,5 KB
R1-1609852.zip	2016/10/01 6:30	311,4 KB
R1-1609853.zip	2016/10/01 5:59	159,4 KB
R1-1609854.zip	2016/10/01 5:59	147,5 KB
R1-1609855.zip	2016/10/01 5:59	44,9 KB
R1-1609856.zip	2016/10/01 5:59	73,6 KB
R1-1609857.zip	2016/10/01 5:59	51,9 KB
R1-1609858.zip	2016/10/01 5:59	59,9 KB
R1-1609859.zip	2016/10/01 5:59	13,5 KB
R1-1609860.zip	2016/10/01 6:46	58,6 KB
R1-1609861.zip	2016/10/01 5:59	56,2 KB
R1-1609862.zip	2016/10/01 6:54	95,9 KB
R1-1609863.zip	2016/10/01 5:59	43,1 KB
R1-1609864.zip	2016/10/01 6:39	242,3 KB
R1-1609865.zip	2016/09/30 21:26	65,4 KB
R1-1609866.zip	2016/09/30 21:26	67,6 KB
R1-1609867.zip	2016/09/30 21:26	19,3 KB
R1-1609868.zip	2016/09/30 21:26	21,2 KB
R1-1609869.zip	2016/09/30 21:25	66,7 KB
R1-1609870.zip	2016/09/30 21:25	121,7 KB
R1-1609871.zip	2016/09/30 21:25	184,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609872.zip	2016/09/30 21:25	176,2 KB
R1-1609873.zip	2016/09/30 21:25	37,4 KB
R1-1609874.zip	2016/09/30 21:25	37,4 KB
R1-1609875.zip	2016/09/30 21:25	83,9 KB
R1-1609876.zip	2016/09/30 21:25	57,3 KB
R1-1609877.zip	2016/09/30 21:25	69,5 KB
R1-1609878.zip	2016/10/01 8:34	236,5 KB
R1-1609879.zip	2016/09/30 7:50	47,2 KB
R1-1609880.zip	2016/09/30 7:50	48,2 KB
R1-1609882.zip	2016/09/30 9:44	27,1 KB
R1-1609883.zip	2016/09/30 9:44	127,1 KB
R1-1609884.zip	2016/09/30 9:44	35,5 KB
R1-1609885.zip	2016/09/30 3:18	106,5 KB
R1-1609886.zip	2016/09/30 3:18	202,3 KB
R1-1609887.zip	2016/10/01 1:17	231,5 KB
R1-1609888.zip	2016/09/30 3:58	47,8 KB
R1-1609889.zip	2016/10/01 1:17	499,6 KB
R1-1609890.zip	2016/09/30 17:16	590,6 KB
R1-1609891.zip	2016/10/01 1:18	439,6 KB
R1-1609892.zip	2016/10/01 1:18	368,9 KB
R1-1609893.zip	2016/10/01 1:18	55,8 KB
R1-1609894.zip	2016/10/01 1:19	85,6 KB
R1-1609895.zip	2016/10/01 4:37	10076,9 KB
R1-1609896.zip	2016/10/01 2:12	901,7 KB
R1-1609897.zip	2016/10/01 2:05	514,8 KB
R1-1609898.zip	2016/10/01 2:04	201,9 KB
R1-1609899.zip	2016/10/01 2:04	228,7 KB
R1-1609900.zip	2016/10/01 1:19	190,4 KB
R1-1609901.zip	2016/10/01 1:19	257,7 KB
R1-1609902.zip	2016/10/01 1:19	182,8 KB
R1-1609903.zip	2016/10/01 1:20	329,9 KB
R1-1609904.zip	2016/10/01 1:20	180 KB
R1-1609905.zip	2016/10/01 1:20	27,7 KB
R1-1609906.zip	2016/10/01 1:20	122,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609907.zip	2016/10/01 1:21	86,6 KB
R1-1609908.zip	2016/09/30 9:34	68,6 KB
R1-1609909.zip	2016/10/01 1:21	61,7 KB
R1-1609910.zip	2016/10/01 1:21	71 KB
R1-1609911.zip	2016/10/01 1:21	76,4 KB
R1-1609912.zip	2016/10/01 1:21	99,8 KB
R1-1609913.zip	2016/10/01 1:22	49,2 KB
R1-1609914.zip	2016/10/01 5:12	50,8 KB
R1-1609915.zip	2016/10/01 5:12	40,8 KB
R1-1609916.zip	2016/10/01 5:12	22,1 KB
R1-1609917.zip	2016/10/01 7:18	91,3 KB
R1-1609918.zip	2016/10/02 5:25	57 KB
R1-1609919.zip	2016/10/01 5:12	67,9 KB
R1-1609920.zip	2016/10/01 1:39	264,8 KB
R1-1609921.zip	2016/10/01 0:47	319,4 KB
R1-1609922.zip	2016/10/01 0:47	55,4 KB
R1-1609923.zip	2016/10/01 0:47	80,9 KB
R1-1609924.zip	2016/10/01 0:47	70,4 KB
R1-1609925.zip	2016/10/01 0:47	311,8 KB
R1-1609926.zip	2016/10/01 0:47	259,7 KB
R1-1609927.zip	2016/10/01 0:47	345,4 KB
R1-1609928.zip	2016/10/01 0:48	51,9 KB
R1-1609929.zip	2016/10/01 0:48	83,2 KB
R1-1609930.zip	2016/10/01 0:48	39,6 KB
R1-1609931.zip	2016/10/01 0:48	42,8 KB
R1-1609932.zip	2016/09/30 18:39	185,4 KB
R1-1609933.zip	2016/09/30 18:39	97,8 KB
R1-1609934.zip	2016/10/01 3:13	42 KB
R1-1609936.zip	2016/10/01 3:11	29 KB
R1-1609937.zip	2016/10/04 5:50	34,1 KB
R1-1609938.zip	2016/10/04 5:51	113,6 KB
R1-1609939.zip	2016/10/01 3:07	29,2 KB
R1-1609940.zip	2016/10/01 3:07	27,9 KB
R1-1609941.zip	2016/10/01 3:07	48,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609942.zip	2016/10/01 3:07	30,1 KB
R1-1609943.zip	2016/10/01 3:07	30,1 KB
R1-1609944.zip	2016/10/01 1:36	31,4 KB
R1-1609945.zip	2016/10/01 1:36	27,3 KB
R1-1609946.zip	2016/10/01 1:36	36,3 KB
R1-1609947.zip	2016/10/01 1:36	59,9 KB
R1-1609948.zip	2016/10/01 1:36	51,6 KB
R1-1609949.zip	2016/10/01 1:36	30,9 KB
R1-1609950.zip	2016/10/01 1:36	62 KB
R1-1609951.zip	2016/10/01 1:36	32,4 KB
R1-1609952.zip	2016/10/01 1:36	46,8 KB
R1-1609953.zip	2016/10/01 1:36	34,7 KB
R1-1609954.zip	2016/10/01 1:36	72,7 KB
R1-1609955.zip	2016/10/01 1:36	95,6 KB
R1-1609956.zip	2016/10/01 1:37	88,8 KB
R1-1609957.zip	2016/10/01 1:37	17,2 KB
R1-1609958.zip	2016/10/01 1:37	176,9 KB
R1-1609959.zip	2016/10/01 1:37	22,7 KB
R1-1609960.zip	2016/10/01 1:37	165,1 KB
R1-1609961.zip	2016/10/01 1:37	23,6 KB
R1-1609962.zip	2016/10/01 1:37	87,4 KB
R1-1609963.zip	2016/10/01 1:37	22,6 KB
R1-1609964.zip	2016/10/01 5:36	77,6 KB
R1-1609965.zip	2016/10/01 2:48	32,3 KB
R1-1609966.zip	2016/10/01 5:36	28,9 KB
R1-1609967.zip	2016/10/01 2:48	149,5 KB
R1-1609968.zip	2016/10/01 2:48	47,2 KB
R1-1609969.zip	2016/10/01 2:48	138,7 KB
R1-1609970.zip	2016/10/01 2:48	297,5 KB
R1-1609971.zip	2016/10/01 2:48	222,5 KB
R1-1609972.zip	2016/10/01 2:48	46,6 KB
R1-1609973.zip	2016/10/01 2:48	56,2 KB
R1-1609974.zip	2016/10/01 1:38	34 KB
R1-1609975.zip	2016/10/01 1:38	54,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1609976.zip	2016/10/01 1:38	105 KB
R1-1609977.zip	2016/10/01 1:38	54,1 KB
R1-1609978.zip	2016/10/01 2:16	191,4 KB
R1-1609979.zip	2016/10/01 2:16	527,4 KB
R1-1609980.zip	2016/10/01 2:16	80,4 KB
R1-1609981.zip	2016/10/01 2:16	79,5 KB
R1-1609982.zip	2016/10/01 2:16	75,1 KB
R1-1609983.zip	2016/10/01 2:20	314 KB
R1-1609984.zip	2016/10/01 2:20	79,4 KB
R1-1609985.zip	2016/10/01 2:20	279,4 KB
R1-1609986.zip	2016/10/01 2:20	77,7 KB
R1-1609987.zip	2016/10/01 1:40	1382,2 KB
R1-1609988.zip	2016/10/01 1:40	429,2 KB
R1-1609989.zip	2016/10/01 1:40	37,7 KB
R1-1609990.zip	2016/10/01 1:40	315,9 KB
R1-1609991.zip	2016/10/01 1:40	126,6 KB
R1-1609992.zip	2016/10/01 1:42	77,5 KB
R1-1609993.zip	2016/10/01 1:42	123,9 KB
R1-1609994.zip	2016/10/01 1:42	78,5 KB
R1-1609995.zip	2016/10/01 1:42	381,4 KB
R1-1609996.zip	2016/10/01 2:26	119,6 KB
R1-1609997.zip	2016/10/01 2:26	229,8 KB
R1-1609998.zip	2016/10/01 2:26	198,9 KB
R1-1609999.zip	2016/10/01 2:26	148,9 KB
R1-1610000.zip	2016/10/01 2:58	567,7 KB
R1-1610001.zip	2016/10/01 2:58	130,8 KB
R1-1610002.zip	2016/10/01 2:58	301,5 KB
R1-1610003.zip	2016/10/01 2:58	77,3 KB
R1-1610004.zip	2016/10/01 2:58	75,2 KB
R1-1610005.zip	2016/10/01 2:55	89,1 KB
R1-1610006.zip	2016/10/01 2:55	57,1 KB
R1-1610007.zip	2016/10/01 1:53	453,7 KB
R1-1610008.zip	2016/10/01 1:53	368,3 KB
R1-1610009.zip	2016/10/01 1:53	481,8 KB

Petitioners' Exhibit 1007, p. 1061
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610010.zip	2016/10/01 1:53	481 KB
R1-1610011.zip	2016/10/01 1:53	581,6 KB
R1-1610012.zip	2016/10/01 1:53	401 KB
R1-1610013.zip	2016/10/01 1:54	32,8 KB
R1-1610014.zip	2016/10/01 3:41	44,6 KB
R1-1610015.zip	2016/10/01 6:14	67,4 KB
R1-1610016.zip	2016/10/01 1:53	61,7 KB
R1-1610017.zip	2016/10/01 2:33	45,1 KB
R1-1610018.zip	2016/10/01 3:52	56,9 KB
R1-1610019.zip	2016/10/01 3:52	80,6 KB
R1-1610020.zip	2016/10/01 3:52	77,8 KB
R1-1610021.zip	2016/10/01 3:52	65,3 KB
R1-1610022.zip	2016/10/01 1:58	32,8 KB
R1-1610023.zip	2016/10/01 1:58	31,5 KB
R1-1610024.zip	2016/10/01 1:58	49,3 KB
R1-1610025.zip	2016/09/30 11:59	45,4 KB
R1-1610026.zip	2016/09/30 11:59	53,2 KB
R1-1610027.zip	2016/09/30 11:59	61 KB
R1-1610028.zip	2016/09/30 11:59	53,5 KB
R1-1610029.zip	2016/10/01 2:37	53,4 KB
R1-1610030.zip	2016/10/01 2:37	167,1 KB
R1-1610031.zip	2016/10/01 2:37	212,1 KB
R1-1610032.zip	2016/10/01 2:37	115,4 KB
R1-1610033.zip	2016/10/01 2:37	97 KB
R1-1610034.zip	2016/10/01 2:37	50,8 KB
R1-1610035.zip	2016/09/30 13:03	33,6 KB
R1-1610036.zip	2016/09/30 13:03	35,8 KB
R1-1610037.zip	2016/09/30 13:03	42,2 KB
R1-1610038.zip	2016/09/30 13:03	143,6 KB
R1-1610039.zip	2016/09/30 13:03	98 KB
R1-1610040.zip	2016/10/01 1:58	124,2 KB
R1-1610041.zip	2016/10/01 1:58	392,5 KB
R1-1610042.zip	2016/10/01 5:06	78,9 KB
R1-1610043.zip	2016/10/01 5:06	187,7 KB

Petitioners' Exhibit 1007, p. 1062
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610044.zip	2016/10/01 5:06	140,5 KB
R1-1610045.zip	2016/10/01 5:06	130,1 KB
R1-1610046.zip	2016/10/01 5:07	226 KB
R1-1610047.zip	2016/10/01 5:06	544,7 KB
R1-1610048.zip	2016/10/01 5:06	230,6 KB
R1-1610049.zip	2016/10/01 5:06	369,6 KB
R1-1610050.zip	2016/10/01 5:06	252 KB
R1-1610051.zip	2016/10/01 1:58	119,8 KB
R1-1610052.zip	2016/10/01 1:57	499,6 KB
R1-1610053.zip	2016/10/01 1:58	321 KB
R1-1610054.zip	2016/10/01 1:58	237,8 KB
R1-1610055.zip	2016/10/01 1:58	125,5 KB
R1-1610056.zip	2016/10/01 1:58	580,9 KB
R1-1610057.zip	2016/10/01 1:58	176,4 KB
R1-1610058.zip	2016/10/01 5:07	54,5 KB
R1-1610059.zip	2016/10/01 1:58	587 KB
R1-1610060.zip	2016/10/01 1:58	842,4 KB
R1-1610061.zip	2016/10/01 5:07	459,2 KB
R1-1610062.zip	2016/10/01 2:38	718,3 KB
R1-1610063.zip	2016/10/01 4:51	93,3 KB
R1-1610064.zip	2016/10/01 2:38	121,6 KB
R1-1610065.zip	2016/10/01 2:38	50,9 KB
R1-1610066.zip	2016/10/01 4:51	44,6 KB
R1-1610067.zip	2016/10/01 2:38	61,3 KB
R1-1610068.zip	2016/10/01 2:38	164,8 KB
R1-1610069.zip	2016/10/01 4:51	71,2 KB
R1-1610070.zip	2016/10/01 2:38	124,2 KB
R1-1610071.zip	2016/10/01 2:38	150,6 KB
R1-1610072.zip	2016/10/01 2:38	57,6 KB
R1-1610073.zip	2016/10/01 4:51	96,4 KB
R1-1610074.zip	2016/10/01 4:51	285,2 KB
R1-1610075.zip	2016/10/01 4:51	198,1 KB
R1-1610076.zip	2016/10/01 1:58	326,9 KB
R1-1610077.zip	2016/10/05 13:24	454,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610078.zip	2016/10/05 13:23	207,8 KB
R1-1610079.zip	2016/10/01 5:07	192 KB
R1-1610080.zip	2016/10/01 5:07	89,9 KB
R1-1610081.zip	2016/10/01 5:07	79,3 KB
R1-1610082.zip	2016/09/30 13:03	65,5 KB
R1-1610083.zip	2016/10/01 5:07	230,5 KB
R1-1610084.zip	2016/10/01 5:07	130 KB
R1-1610085.zip	2016/10/01 5:07	48,5 KB
R1-1610086.zip	2016/10/01 5:07	136,9 KB
R1-1610087.zip	2016/10/01 5:07	239,4 KB
R1-1610088.zip	2016/10/01 1:58	211,5 KB
R1-1610089.zip	2016/10/01 1:58	33,6 KB
R1-1610090.zip	2016/10/01 1:58	210,8 KB
R1-1610091.zip	2016/09/30 10:12	163,3 KB
R1-1610092.zip	2016/09/30 10:12	41,8 KB
R1-1610093.zip	2016/09/30 10:12	31,7 KB
R1-1610094.zip	2016/10/01 3:12	47,1 KB
R1-1610095.zip	2016/10/01 2:25	27,3 KB
R1-1610096.zip	2016/09/30 23:55	64,3 KB
R1-1610097.zip	2016/09/30 23:55	31,7 KB
R1-1610098.zip	2016/09/30 23:55	153,9 KB
R1-1610099.zip	2016/09/30 23:55	64 KB
R1-1610100.zip	2016/09/30 23:55	32,4 KB
R1-1610101.zip	2016/09/30 23:55	58,9 KB
R1-1610102.zip	2016/09/30 23:55	61 KB
R1-1610103.zip	2016/09/30 15:20	45,9 KB
R1-1610104.zip	2016/09/30 23:55	79,3 KB
R1-1610105.zip	2016/09/30 23:55	29,3 KB
R1-1610106.zip	2016/09/30 7:47	42,5 KB
R1-1610107.zip	2016/09/30 23:09	369,8 KB
R1-1610108.zip	2016/10/01 5:15	1367,3 KB
R1-1610109.zip	2016/09/30 22:33	615,4 KB
R1-1610110.zip	2016/09/30 7:47	62,9 KB
R1-1610111.zip	2016/10/01 4:06	130,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610112.zip	2016/10/01 4:06	631,5 KB
R1-1610113.zip	2016/10/01 4:06	784,8 KB
R1-1610114.zip	2016/10/01 4:06	190,9 KB
R1-1610115.zip	2016/10/01 6:07	133,8 KB
R1-1610116.zip	2016/10/01 4:20	76,6 KB
R1-1610117.zip	2016/10/01 4:06	429,8 KB
R1-1610118.zip	2016/10/01 4:58	176 KB
R1-1610119.zip	2016/10/01 4:58	99,5 KB
R1-1610120.zip	2016/10/01 4:59	78,5 KB
R1-1610121.zip	2016/10/01 4:59	232,2 KB
R1-1610122.zip	2016/10/01 5:00	28,3 KB
R1-1610123.zip	2016/10/01 6:16	282 KB
R1-1610124.zip	2016/10/01 4:23	174,7 KB
R1-1610125.zip	2016/10/01 6:18	1656,6 KB
R1-1610126.zip	2016/10/01 6:19	2094,2 KB
R1-1610127.zip	2016/10/01 6:19	1411,6 KB
R1-1610128.zip	2016/10/18 20:55	172,9 KB
R1-1610129.zip	2016/10/01 7:40	173,1 KB
R1-1610130.zip	2016/10/01 6:22	1122,5 KB
R1-1610131.zip	2016/10/01 6:23	203,7 KB
R1-1610132.zip	2016/10/01 7:12	653,4 KB
R1-1610133.zip	2016/10/01 4:25	253,9 KB
R1-1610134.zip	2016/10/01 5:51	236,8 KB
R1-1610135.zip	2016/10/01 5:54	415,5 KB
R1-1610136.zip	2016/10/01 5:58	67,5 KB
R1-1610137.zip	2016/10/01 5:25	550,9 KB
R1-1610138.zip	2016/10/01 5:25	267,6 KB
R1-1610139.zip	2016/10/01 5:57	236,8 KB
R1-1610140.zip	2016/10/01 5:24	391,7 KB
R1-1610141.zip	2016/10/01 5:24	212,6 KB
R1-1610142.zip	2016/10/01 5:56	292,2 KB
R1-1610143.zip	2016/10/01 5:20	318 KB
R1-1610144.zip	2016/10/01 6:10	52,3 KB
R1-1610145.zip	2016/10/01 4:33	180,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610146.zip	2016/10/01 4:17	199,9 KB
R1-1610147.zip	2016/10/01 4:17	345,1 KB
R1-1610148.zip	2016/10/01 4:17	82,2 KB
R1-1610149.zip	2016/10/01 4:17	63,5 KB
R1-1610150.zip	2016/10/01 4:34	47,8 KB
R1-1610151.zip	2016/10/01 4:17	108,9 KB
R1-1610152.zip	2016/10/01 6:38	1682,7 KB
R1-1610153.zip	2016/10/01 6:34	138,2 KB
R1-1610154.zip	2016/10/01 4:17	113,9 KB
R1-1610155.zip	2016/10/01 4:36	65,8 KB
R1-1610156.zip	2016/10/01 6:01	252,5 KB
R1-1610157.zip	2016/10/01 7:17	166,2 KB
R1-1610158.zip	2016/10/01 7:16	41,1 KB
R1-1610159.zip	2016/10/01 4:38	277,7 KB
R1-1610161.zip	2016/10/01 4:39	347,5 KB
R1-1610163.zip	2016/10/01 5:33	257,5 KB
R1-1610164.zip	2016/10/01 4:42	151,7 KB
R1-1610165.zip	2016/10/01 4:40	170,8 KB
R1-1610167.zip	2016/10/01 5:01	67,7 KB
R1-1610168.zip	2016/10/01 7:49	64,8 KB
R1-1610169.zip	2016/10/01 5:30	182 KB
R1-1610170.zip	2016/10/01 7:48	168 KB
R1-1610171.zip	2016/10/01 5:30	233,6 KB
R1-1610172.zip	2016/10/01 4:45	85,7 KB
R1-1610173.zip	2016/10/01 5:03	192 KB
R1-1610174.zip	2016/10/01 5:04	55,8 KB
R1-1610175.zip	2016/10/01 5:05	43 KB
R1-1610176.zip	2016/10/01 5:05	27,2 KB
R1-1610177.zip	2016/10/01 6:05	92,3 KB
R1-1610178.zip	2016/10/01 6:05	88,4 KB
R1-1610179.zip	2016/10/01 6:05	82,4 KB
R1-1610180.zip	2016/10/01 6:27	174,5 KB
R1-1610181.zip	2016/10/01 6:28	734,5 KB
R1-1610182.zip	2016/10/01 7:21	288,8 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1610183.zip	2016/10/01 5:08	161,5 KB
R1-1610184.zip	2016/10/01 5:08	125,2 KB
R1-1610185.zip	2016/10/01 5:09	31,4 KB
R1-1610186.zip	2016/10/01 5:09	116,1 KB
R1-1610187.zip	2016/10/01 5:10	295,3 KB
R1-1610188.zip	2016/10/01 5:11	230,5 KB
R1-1610189.zip	2016/10/01 4:46	29,2 KB
R1-1610190.zip	2016/10/01 4:47	64,7 KB
R1-1610191.zip	2016/10/01 6:17	143,4 KB
R1-1610192.zip	2016/10/01 6:17	118,1 KB
R1-1610193.zip	2016/10/01 0:59	31,6 KB
R1-1610194.zip	2016/10/01 0:59	39,6 KB
R1-1610195.zip	2016/10/01 0:59	115,1 KB
R1-1610196.zip	2016/10/01 0:59	43,8 KB
R1-1610197.zip	2016/10/01 7:47	30,3 KB
R1-1610198.zip	2016/10/01 7:47	25,1 KB
R1-1610199.zip	2016/10/01 7:47	40,6 KB
R1-1610200.zip	2016/10/01 7:47	25,2 KB
R1-1610201.zip	2016/10/01 7:47	148,8 KB
R1-1610202.zip	2016/10/03 3:43	86,5 KB
R1-1610203.zip	2016/10/01 1:29	24,6 KB
R1-1610204.zip	2016/10/01 1:30	27,7 KB
R1-1610206.zip	2016/09/30 8:53	22,2 KB
R1-1610207.zip	2016/09/30 8:53	34,2 KB
R1-1610208.zip	2016/10/01 3:06	55,5 KB
R1-1610209.zip	2016/10/01 1:44	31,7 KB
R1-1610210.zip	2016/10/01 1:44	79,9 KB
R1-1610211.zip	2016/09/30 13:54	34,8 KB
R1-1610212.zip	2016/09/30 22:30	65,4 KB
R1-1610213.zip	2016/09/30 19:56	72,7 KB
R1-1610214.zip	2016/09/30 19:56	32,8 KB
R1-1610215.zip	2016/09/30 23:06	402,8 KB
R1-1610216.zip	2016/10/01 1:28	33,7 KB
R1-1610217.zip	2016/09/30 14:19	240,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610218.zip	2016/10/01 6:01	212,6 KB
R1-1610219.zip	2016/09/30 20:15	21,2 KB
R1-1610220.zip	2016/10/01 9:17	61,6 KB
R1-1610221.zip	2016/10/01 9:17	151,2 KB
R1-1610222.zip	2016/10/01 9:17	157 KB
R1-1610223.zip	2016/09/30 20:26	13,5 KB
R1-1610224.zip	2016/09/30 13:11	149,2 KB
R1-1610225.zip	2016/09/30 17:07	30,5 KB
R1-1610226.zip	2016/09/30 17:07	247,2 KB
R1-1610227.zip	2016/09/30 17:08	438,3 KB
R1-1610228.zip	2016/09/30 9:55	53,1 KB
R1-1610229.zip	2016/09/30 17:08	903,7 KB
R1-1610230.zip	2016/09/30 10:13	35,1 KB
R1-1610231.zip	2016/09/30 17:08	81,8 KB
R1-1610232.zip	2016/09/30 10:13	46,2 KB
R1-1610233.zip	2016/09/30 21:32	121,8 KB
R1-1610234.zip	2016/09/30 21:32	96,5 KB
R1-1610235.zip	2016/09/30 21:32	54,8 KB
R1-1610236.zip	2016/09/30 21:32	35,9 KB
R1-1610237.zip	2016/09/30 21:32	66,7 KB
R1-1610238.zip	2016/09/30 10:35	156,1 KB
R1-1610239.zip	2016/09/30 15:04	105,8 KB
R1-1610240.zip	2016/09/30 15:05	184,9 KB
R1-1610241.zip	2016/09/30 15:05	122,9 KB
R1-1610242.zip	2016/09/30 15:05	148,9 KB
R1-1610243.zip	2016/09/30 15:04	347,7 KB
R1-1610244.zip	2016/09/30 15:04	224,8 KB
R1-1610245.zip	2016/09/30 20:10	293,1 KB
R1-1610247.zip	2016/09/30 15:04	124,9 KB
R1-1610248.zip	2016/09/30 15:07	33,8 KB
R1-1610249.zip	2016/09/30 21:37	144,7 KB
R1-1610250.zip	2016/09/30 21:37	37,6 KB
R1-1610251.zip	2016/09/30 21:37	184 KB
R1-1610252.zip	2016/09/30 21:37	51,3 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1610253.zip	2016/09/30 21:37	702,3 KB
R1-1610254.zip	2016/09/30 21:37	167,3 KB
R1-1610255.zip	2016/09/30 21:37	149,4 KB
R1-1610256.zip	2016/09/30 21:37	81,1 KB
R1-1610257.zip	2016/09/30 21:37	39,9 KB
R1-1610259.zip	2016/09/30 21:37	210,3 KB
R1-1610260.zip	2016/09/30 21:37	226,7 KB
R1-1610261.zip	2016/09/30 21:37	161,3 KB
R1-1610262.zip	2016/09/30 21:37	33,9 KB
R1-1610263.zip	2016/09/30 21:37	191,6 KB
R1-1610264.zip	2016/09/30 21:37	35 KB
R1-1610265.zip	2016/09/30 22:01	33,6 KB
R1-1610266.zip	2016/09/30 21:37	37,3 KB
R1-1610267.zip	2016/09/30 21:37	39,5 KB
R1-1610268.zip	2016/09/30 21:36	36,1 KB
R1-1610269.zip	2016/09/30 21:36	35,8 KB
R1-1610270.zip	2016/09/30 21:36	55,8 KB
R1-1610271.zip	2016/09/30 21:36	500 KB
R1-1610272.zip	2016/09/30 21:36	43,9 KB
R1-1610273.zip	2016/09/30 21:36	119,7 KB
R1-1610274.zip	2016/09/30 21:36	107,3 KB
R1-1610275.zip	2016/09/30 21:36	117,2 KB
R1-1610276.zip	2016/09/30 21:36	199,2 KB
R1-1610277.zip	2016/09/30 21:37	455,5 KB
R1-1610278.zip	2016/09/30 15:07	386,2 KB
R1-1610279.zip	2016/09/30 15:07	32 KB
R1-1610280.zip	2016/09/30 15:07	151,7 KB
R1-1610281.zip	2016/09/30 15:07	56,1 KB
R1-1610282.zip	2016/09/30 15:07	220,7 KB
R1-1610283.zip	2016/09/30 15:07	366 KB
R1-1610284.zip	2016/09/30 15:07	39,2 KB
R1-1610285.zip	2016/09/30 15:07	154 KB
R1-1610286.zip	2016/09/30 21:35	39 KB
R1-1610287.zip	2016/09/30 21:35	140,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610288.zip	2016/09/30 21:35	267,8 KB
R1-1610289.zip	2016/09/30 21:35	184,8 KB
R1-1610290.zip	2016/09/30 21:35	179,7 KB
R1-1610291.zip	2016/09/30 21:35	28,5 KB
R1-1610292.zip	2016/09/30 21:35	73,3 KB
R1-1610293.zip	2016/09/30 21:35	43,4 KB
R1-1610295.zip	2016/09/30 21:35	273,9 KB
R1-1610296.zip	2016/09/30 21:35	37,8 KB
R1-1610297.zip	2016/09/30 17:08	191,5 KB
R1-1610298.zip	2016/10/18 20:17	27,5 KB
R1-1610299.zip	2016/10/01 9:03	147,8 KB
R1-1610300.zip	2016/09/30 19:19	30,8 KB
R1-1610301.zip	2016/09/30 22:30	65,2 KB
R1-1610302.zip	2016/09/30 12:03	130,8 KB
R1-1610303.zip	2016/10/01 5:12	41,7 KB
R1-1610304.zip	2016/09/30 12:44	121,4 KB
R1-1610305.zip	2016/09/30 12:44	259,9 KB
R1-1610306.zip	2016/10/01 5:12	288,9 KB
R1-1610307.zip	2016/09/30 12:44	18,8 KB
R1-1610308.zip	2016/09/30 22:47	35,8 KB
R1-1610309.zip	2016/10/01 5:12	611,5 KB
R1-1610310.zip	2016/09/30 13:22	78,8 KB
R1-1610311.zip	2016/09/30 13:22	47,8 KB
R1-1610312.zip	2016/09/30 13:22	61,5 KB
R1-1610313.zip	2016/09/30 13:32	24,1 KB
R1-1610314.zip	2016/09/30 13:30	85,2 KB
R1-1610315.zip	2016/09/30 20:25	119,8 KB
R1-1610316.zip	2016/09/30 20:25	19,3 KB
R1-1610317.zip	2016/09/30 20:23	63,8 KB
R1-1610318.zip	2016/09/30 21:35	42,4 KB
R1-1610319.zip	2016/10/01 1:58	143,8 KB
R1-1610320.zip	2016/10/01 1:58	136,9 KB
R1-1610321.zip	2016/09/30 17:46	533,4 KB
R1-1610322.zip	2016/09/30 17:46	50,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610323.zip	2016/09/30 17:46	21,7 KB
R1-1610324.zip	2016/09/30 17:46	84,5 KB
R1-1610325.zip	2016/09/30 17:46	24 KB
R1-1610326.zip	2016/09/30 17:46	20,4 KB
R1-1610327.zip	2016/09/30 17:46	111,5 KB
R1-1610328.zip	2016/09/30 17:46	32,3 KB
R1-1610329.zip	2016/09/30 17:46	40,4 KB
R1-1610330.zip	2016/09/30 17:46	25,5 KB
R1-1610331.zip	2016/09/30 17:46	59,8 KB
R1-1610332.zip	2016/09/30 17:46	65,4 KB
R1-1610333.zip	2016/09/30 17:45	17,7 KB
R1-1610334.zip	2016/09/30 17:45	18,8 KB
R1-1610335.zip	2016/09/30 17:45	19,1 KB
R1-1610336.zip	2016/09/30 17:45	94,7 KB
R1-1610337.zip	2016/09/30 17:45	64 KB
R1-1610338.zip	2016/09/30 17:46	8,4 KB
R1-1610339.zip	2016/09/30 17:46	25,3 KB
R1-1610340.zip	2016/09/30 17:46	32,8 KB
R1-1610341.zip	2016/09/30 17:46	129,5 KB
R1-1610342.zip	2016/09/30 17:46	21,1 KB
R1-1610343.zip	2016/09/30 17:46	20,2 KB
R1-1610344.zip	2016/09/30 17:46	58,4 KB
R1-1610345.zip	2016/10/01 1:22	219,5 KB
R1-1610346.zip	2016/10/01 5:10	64,3 KB
R1-1610347.zip	2016/10/01 5:10	23 KB
R1-1610348.zip	2016/10/01 5:10	64 KB
R1-1610349.zip	2016/10/01 5:10	60,2 KB
R1-1610350.zip	2016/09/30 17:28	332,4 KB
R1-1610351.zip	2016/10/01 2:07	55,7 KB
R1-1610352.zip	2016/10/01 2:07	32,4 KB
R1-1610353.zip	2016/10/01 5:43	68,4 KB
R1-1610354.zip	2016/10/01 5:43	91,9 KB
R1-1610356.zip	2016/10/01 1:22	87,5 KB
R1-1610357.zip	2016/09/30 22:07	22,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610358.zip	2016/09/30 22:07	24,1 KB
R1-1610359.zip	2016/09/30 19:40	29,4 KB
R1-1610360.zip	2016/09/30 19:40	108,9 KB
R1-1610361.zip	2016/09/30 15:37	246,2 KB
R1-1610362.zip	2016/09/30 15:37	32,9 KB
R1-1610363.zip	2016/10/01 6:17	54 KB
R1-1610364.zip	2016/10/01 7:05	43,5 KB
R1-1610365.zip	2016/10/01 6:17	211,1 KB
R1-1610366.zip	2016/10/01 6:17	383,8 KB
R1-1610367.zip	2016/10/01 6:17	2557,5 KB
R1-1610368.zip	2016/10/01 6:17	813,3 KB
R1-1610369.zip	2016/10/01 0:52	24,2 KB
R1-1610370.zip	2016/10/01 0:52	25,1 KB
R1-1610371.zip	2016/10/01 4:50	92 KB
R1-1610372.zip	2016/10/01 4:50	131,3 KB
R1-1610374.zip	2016/10/01 7:24	53,6 KB
R1-1610375.zip	2016/10/01 7:06	1821,5 KB
R1-1610376.zip	2016/10/01 7:22	53 KB
R1-1610377.zip	2016/10/01 6:17	174,1 KB
R1-1610378.zip	2016/10/01 10:10	199,4 KB
R1-1610379.zip	2016/10/01 4:50	146,7 KB
R1-1610380.zip	2016/10/01 4:50	269 KB
R1-1610382.zip	2016/10/03 13:36	21,8 KB
R1-1610383.zip	2016/10/01 5:35	148,8 KB
R1-1610384.zip	2016/10/01 5:35	26,6 KB
R1-1610385.zip	2016/10/01 5:35	57,5 KB
R1-1610386.zip	2016/10/01 5:36	63,3 KB
R1-1610387.zip	2016/10/01 5:35	119,1 KB
R1-1610388.zip	2016/10/01 5:50	22,3 KB
R1-1610389.zip	2016/10/01 7:00	23,3 KB
R1-1610390.zip	2016/10/01 5:35	68,4 KB
R1-1610391.zip	2016/10/01 5:35	31 KB
R1-1610392.zip	2016/10/01 5:35	23,1 KB
R1-1610393.zip	2016/10/01 5:35	134,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610394.zip	2016/10/01 5:35	96,8 KB
R1-1610395.zip	2016/10/01 5:35	1604,2 KB
R1-1610396.zip	2016/10/01 5:35	73,8 KB
R1-1610397.zip	2016/10/01 3:51	202 KB
R1-1610398.zip	2016/10/01 5:10	76,7 KB
R1-1610399.zip	2016/10/01 5:10	73,8 KB
R1-1610400.zip	2016/10/01 6:31	217,7 KB
R1-1610402.zip	2016/10/01 7:06	398,8 KB
R1-1610403.zip	2016/09/30 18:26	235 KB
R1-1610404.zip	2016/09/30 15:53	156,1 KB
R1-1610405.zip	2016/09/30 21:37	34,4 KB
R1-1610406.zip	2016/09/30 17:00	244,5 KB
R1-1610407.zip	2016/09/30 17:00	84,3 KB
R1-1610408.zip	2016/09/30 20:30	35,2 KB
R1-1610409.zip	2016/10/04 7:58	32,4 KB
R1-1610410.zip	2016/10/04 7:58	51,4 KB
R1-1610411.zip	2016/10/18 20:22	170,2 KB
R1-1610412.zip	2016/10/05 6:02	37,1 KB
R1-1610413.zip	2016/10/05 18:45	44,8 KB
R1-1610414.zip	2016/10/06 6:26	69,8 KB
R1-1610415.zip	2016/10/06 18:59	451,2 KB
R1-1610416.zip	2016/10/07 16:12	273,7 KB
R1-1610417.zip	2016/10/06 18:59	48,7 KB
R1-1610418.zip	2016/10/09 16:22	204,3 KB
R1-1610419.zip	2016/10/18 20:21	372,5 KB
R1-1610420.zip	2016/10/18 20:21	343,2 KB
R1-1610421.zip	2016/10/07 16:12	24,9 KB
R1-1610422.zip	2016/10/08 9:31	138,5 KB
R1-1610423.zip	2016/10/18 20:21	12533,9 KB
R1-1610424.zip	2016/10/18 20:19	83,2 KB
R1-1610425.zip	2016/10/10 5:58	51,1 KB
R1-1610426.zip	2016/10/07 11:12	1428,9 KB
R1-1610427.zip	2016/10/08 9:31	20,2 KB
R1-1610428.zip	2016/10/18 20:55	29,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610429.zip	2016/10/18 20:19	302,1 KB
R1-1610430.zip	2016/10/10 5:58	74,2 KB
R1-1610431.zip	2016/10/10 5:58	70,5 KB
R1-1610432.zip	2016/10/10 5:58	85 KB
R1-1610433.zip	2016/10/10 5:58	81,1 KB
R1-1610434.zip	2016/10/10 5:58	148,8 KB
R1-1610435.zip	2016/10/08 9:31	2045,8 KB
R1-1610436.zip	2016/10/10 5:57	36,1 KB
R1-1610437.zip	2016/10/10 5:58	74,9 KB
R1-1610438.zip	2016/10/09 16:22	190,2 KB
R1-1610439.zip	2016/10/09 11:14	4622 KB
R1-1610440.zip	2016/10/09 16:47	22 KB
R1-1610441.zip	2016/10/10 23:00	61,3 KB
R1-1610442.zip	2016/10/10 23:00	151,9 KB
R1-1610443.zip	2016/10/10 23:00	63,3 KB
R1-1610444.zip	2016/10/18 20:19	90 KB
R1-1610445.zip	2016/10/10 23:00	66 KB
R1-1610446.zip	2016/10/18 20:19	231,6 KB
R1-1610447.zip	2016/10/18 20:55	56,2 KB
R1-1610448.zip	2016/10/18 20:55	98 KB
R1-1610450.zip	2016/10/18 20:55	30,3 KB
R1-1610451.zip	2016/10/18 20:55	26,6 KB
R1-1610452.zip	2016/10/18 20:55	29,7 KB
R1-1610453.zip	2016/10/18 20:55	25,6 KB
R1-1610454.zip	2016/10/18 20:55	29,7 KB
R1-1610455.zip	2016/10/18 20:55	25,7 KB
R1-1610456.zip	2016/10/18 20:55	29,3 KB
R1-1610457.zip	2016/10/18 20:55	57,7 KB
R1-1610458.zip	2016/10/18 20:55	23 KB
R1-1610459.zip	2016/10/18 20:55	29 KB
R1-1610460.zip	2016/10/18 20:55	40,6 KB
R1-1610461.zip	2016/10/18 20:55	88,1 KB
R1-1610462.zip	2016/10/18 20:55	27,8 KB
R1-1610463.zip	2016/10/18 20:55	33,8 KB

Petitioners' Exhibit 1007, p. 1074
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610464.zip	2016/10/18 20:55	30 KB
R1-1610465.zip	2016/10/18 20:55	95,6 KB
R1-1610466.zip	2016/10/18 20:55	120,5 KB
R1-1610467.zip	2016/10/18 20:55	53,7 KB
R1-1610468.zip	2016/10/18 20:25	37,8 KB
R1-1610469.zip	2016/10/18 20:25	37,6 KB
R1-1610470.zip	2016/10/18 20:25	38,2 KB
R1-1610471.zip	2016/10/18 20:55	31,2 KB
R1-1610472.zip	2016/10/18 20:25	183 KB
R1-1610473.zip	2016/10/18 20:25	32,8 KB
R1-1610474.zip	2016/10/18 20:55	53,7 KB
R1-1610475.zip	2016/10/18 20:55	34,3 KB
R1-1610476.zip	2016/10/18 20:55	33,7 KB
R1-1610477.zip	2016/10/18 20:54	43,6 KB
R1-1610478.zip	2016/10/18 20:25	472,6 KB
R1-1610479.zip	2016/10/18 20:25	34,9 KB
R1-1610480.zip	2016/10/18 20:25	137,3 KB
R1-1610482.zip	2016/10/10 23:00	23,2 KB
R1-1610483.zip	2016/10/10 23:00	231 KB
R1-1610484.zip	2016/10/10 23:00	33,2 KB
R1-1610485.zip	2016/10/18 20:25	64,4 KB
R1-1610486.zip	2016/10/10 23:00	277,2 KB
R1-1610487.zip	2016/10/10 23:00	26,6 KB
R1-1610488.zip	2016/10/10 22:58	26,5 KB
R1-1610489.zip	2016/10/18 20:54	28,8 KB
R1-1610490.zip	2016/10/10 22:58	47,5 KB
R1-1610491.zip	2016/10/10 22:58	32,3 KB
R1-1610492.zip	2016/10/10 22:58	32,3 KB
R1-1610493.zip	2016/10/18 20:54	29,2 KB
R1-1610494.zip	2016/10/18 20:54	30 KB
R1-1610495.zip	2016/10/18 20:54	29,2 KB
R1-1610496.zip	2016/10/18 20:54	30,1 KB
R1-1610497.zip	2016/10/18 20:54	53,7 KB
R1-1610498.zip	2016/10/10 22:58	51,6 KB

Petitioners' Exhibit 1007, p. 1075
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610499.zip	2016/10/10 22:58	287,8 KB
R1-1610500.zip	2016/10/10 22:58	40,9 KB
R1-1610501.zip	2016/10/18 20:54	53,7 KB
R1-1610502.zip	2016/10/10 22:58	51,7 KB
R1-1610503.zip	2016/10/10 22:58	39,1 KB
R1-1610504.zip	2016/10/18 20:54	49,3 KB
R1-1610505.zip	2016/10/18 20:54	31,2 KB
R1-1610506.zip	2016/10/18 20:54	31,2 KB
R1-1610507.zip	2016/10/18 20:54	115,5 KB
R1-1610508.zip	2016/10/18 20:54	14,9 KB
R1-1610509.zip	2016/10/10 22:58	33,1 KB
R1-1610510.zip	2016/10/10 22:57	31,5 KB
R1-1610511.zip	2016/10/18 20:54	105,7 KB
R1-1610512.zip	2016/10/10 22:57	160,9 KB
R1-1610513.zip	2016/10/10 22:57	103,1 KB
R1-1610514.zip	2016/10/10 22:57	107 KB
R1-1610515.zip	2016/10/10 22:56	39,5 KB
R1-1610516.zip	2016/10/10 22:56	27,8 KB
R1-1610517.zip	2016/10/10 22:56	54,8 KB
R1-1610518.zip	2016/10/18 20:54	59,4 KB
R1-1610519.zip	2016/10/18 20:54	322,5 KB
R1-1610520.zip	2016/10/18 20:54	32,2 KB
R1-1610521.zip	2016/10/10 22:56	71,1 KB
R1-1610522.zip	2016/10/10 22:55	132,5 KB
R1-1610523.zip	2016/10/18 20:27	59,9 KB
R1-1610524.zip	2016/10/10 22:55	33,6 KB
R1-1610525.zip	2016/10/10 22:55	43 KB
R1-1610526.zip	2016/10/10 22:55	32,4 KB
R1-1610527.zip	2016/10/18 20:27	30,1 KB
R1-1610528.zip	2016/10/18 20:27	69,5 KB
R1-1610529.zip	2016/10/18 20:27	52,5 KB
R1-1610530.zip	2016/10/18 20:54	128,7 KB
R1-1610531.zip	2016/10/18 20:54	130,2 KB
R1-1610532.zip	2016/10/18 20:54	117,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610533.zip	2016/10/10 22:55	111,5 KB
R1-1610534.zip	2016/10/10 22:55	50,5 KB
R1-1610535.zip	2016/10/10 22:55	48,5 KB
R1-1610536.zip	2016/10/18 20:26	66,7 KB
R1-1610537.zip	2016/10/18 20:54	46,8 KB
R1-1610538.zip	2016/10/10 22:55	36 KB
R1-1610539.zip	2016/10/18 20:54	38,6 KB
R1-1610540.zip	2016/10/10 22:55	27,5 KB
R1-1610541.zip	2016/10/18 20:54	1429,1 KB
R1-1610542.zip	2016/10/18 20:26	32,5 KB
R1-1610543.zip	2016/10/18 20:26	33,3 KB
R1-1610544.zip	2016/10/18 20:26	107,5 KB
R1-1610545.zip	2016/10/18 20:26	1659,7 KB
R1-1610546.zip	2016/10/18 20:28	174,3 KB
R1-1610547.zip	2016/10/18 20:54	31,2 KB
R1-1610548.zip	2016/10/18 20:28	49,5 KB
R1-1610549.zip	2016/10/18 20:28	56,4 KB
R1-1610550.zip	2016/10/10 22:55	69,9 KB
R1-1610551.zip	2016/10/18 20:28	29,7 KB
R1-1610552.zip	2016/10/18 20:28	30,3 KB
R1-1610553.zip	2016/10/18 20:28	31,2 KB
R1-1610554.zip	2016/10/18 20:28	31,9 KB
R1-1610556.zip	2016/10/18 20:28	30,6 KB
R1-1610557.zip	2016/10/18 20:28	48,6 KB
R1-1610558.zip	2016/10/18 20:54	61,3 KB
R1-1610559.zip	2016/10/18 20:28	47,7 KB
R1-1610560.zip	2016/10/18 20:28	73,7 KB
R1-1610561.zip	2016/10/18 20:28	39,6 KB
R1-1610562.zip	2016/10/18 20:28	51,9 KB
R1-1610563.zip	2016/10/18 20:28	54 KB
R1-1610564.zip	2016/10/18 20:28	38,2 KB
R1-1610565.zip	2016/10/18 20:54	31 KB
R1-1610566.zip	2016/10/18 20:54	50,7 KB
R1-1610567.zip	2016/10/18 20:54	29,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610568.zip	2016/10/18 20:33	72,3 KB
R1-1610569.zip	2016/10/18 20:33	37,4 KB
R1-1610570.zip	2016/10/18 20:33	32,4 KB
R1-1610571.zip	2016/10/18 11:51	32,1 KB
R1-1610572.zip	2016/10/18 11:51	14,2 KB
R1-1610573.zip	2016/10/18 20:54	65,3 KB
R1-1610580.zip	2016/10/18 20:33	2560,6 KB
R1-1610581.zip	2016/10/18 20:33	60,7 KB
R1-1610582.zip	2016/10/18 20:33	56,6 KB
R1-1610583.zip	2016/10/18 20:33	51,8 KB
R1-1610584.zip	2016/10/18 20:54	23,6 KB
R1-1610585.zip	2016/10/18 20:54	8,6 KB
R1-1610586.zip	2016/10/18 20:54	121 KB
R1-1610590.zip	2016/10/18 20:33	26,2 KB
R1-1610591.zip	2016/10/18 20:33	66,2 KB
R1-1610592.zip	2016/10/18 20:33	59,4 KB
R1-1610593.zip	2016/10/18 20:33	37 KB
R1-1610594.zip	2016/10/18 20:33	127,1 KB
R1-1610595.zip	2016/10/18 20:33	50,2 KB
R1-1610596.zip	2016/10/18 20:33	80,5 KB
R1-1610597.zip	2016/10/18 20:33	67,1 KB
R1-1610598.zip	2016/10/18 20:33	55,2 KB
R1-1610600.zip	2016/10/18 20:33	13896 KB
R1-1610601.zip	2016/10/18 20:36	183,1 KB
R1-1610602.zip	2016/10/18 20:36	29,3 KB
R1-1610603.zip	2016/10/18 20:36	21,5 KB
R1-1610604.zip	2016/10/18 20:35	39,2 KB
R1-1610605.zip	2016/10/18 20:54	130 KB
R1-1610606.zip	2016/10/18 20:54	15,1 KB
R1-1610607.zip	2016/10/18 20:35	63,8 KB
R1-1610609.zip	2016/10/18 20:35	211,8 KB
R1-1610610.zip	2016/10/18 20:35	208,9 KB
R1-1610611.zip	2016/10/18 20:35	48,2 KB
R1-1610612.zip	2016/10/18 20:35	53,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610613.zip	2016/10/18 20:35	46,7 KB
R1-1610615.zip	2016/10/18 20:35	48,1 KB
R1-1610616.zip	2016/10/18 20:35	354,4 KB
R1-1610617.zip	2016/10/18 20:35	37,7 KB
R1-1610618.zip	2016/10/18 20:35	34 KB
R1-1610619.zip	2016/10/18 20:35	33 KB
R1-1610620.zip	2016/10/18 20:35	166,2 KB
R1-1610621.zip	2016/10/18 20:35	39,2 KB
R1-1610622.zip	2016/10/18 20:54	72,1 KB
R1-1610623.zip	2016/10/18 20:35	30,4 KB
R1-1610624.zip	2016/10/18 20:35	63,8 KB
R1-1610625.zip	2016/10/18 20:43	67 KB
R1-1610626.zip	2016/10/18 20:43	137,4 KB
R1-1610627.zip	2016/10/18 20:43	37,7 KB
R1-1610628.zip	2016/10/18 20:54	110,5 KB
R1-1610630.zip	2016/10/18 20:43	30,6 KB
R1-1610631.zip	2016/10/18 20:54	34,4 KB
R1-1610632.zip	2016/10/18 20:43	45,6 KB
R1-1610633.zip	2016/10/18 20:54	38,3 KB
R1-1610634.zip	2016/10/18 20:43	161,9 KB
R1-1610635.zip	2016/10/18 20:43	61,6 KB
R1-1610636.zip	2016/10/18 20:43	94,4 KB
R1-1610637.zip	2016/10/18 20:54	114,7 KB
R1-1610638.zip	2016/10/18 20:54	51,6 KB
R1-1610639.zip	2016/10/18 20:45	31,6 KB
R1-1610640.zip	2016/10/18 20:45	31,3 KB
R1-1610641.zip	2016/10/18 20:45	30,9 KB
R1-1610642.zip	2016/10/18 20:45	80,8 KB
R1-1610643.zip	2016/10/18 20:45	30,7 KB
R1-1610644.zip	2016/10/18 20:45	32,2 KB
R1-1610645.zip	2016/10/18 20:54	105 KB
R1-1610647.zip	2016/10/18 20:45	49,5 KB
R1-1610648.zip	2016/10/18 20:54	32,5 KB
R1-1610649.zip	2016/10/18 20:54	45,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610650.zip	2016/10/18 20:45	118,7 KB
R1-1610651.zip	2016/10/18 20:45	55,6 KB
R1-1610652.zip	2016/10/11 23:36	63,4 KB
R1-1610653.zip	2016/10/18 20:54	40,7 KB
R1-1610654.zip	2016/10/18 20:54	39,4 KB
R1-1610655.zip	2016/10/11 23:36	14,8 KB
R1-1610656.zip	2016/10/18 20:54	32,5 KB
R1-1610657.zip	2016/10/18 20:54	45,5 KB
R1-1610658.zip	2016/10/11 23:36	26,9 KB
R1-1610659.zip	2016/10/18 20:45	317,8 KB
R1-1610660.zip	2016/10/18 20:45	194,3 KB
R1-1610661.zip	2016/10/18 20:45	30 KB
R1-1610662.zip	2016/10/18 20:45	28,6 KB
R1-1610663.zip	2016/10/18 20:45	27,4 KB
R1-1610664.zip	2016/10/18 20:45	30,9 KB
R1-1610665.zip	2016/10/19 9:26	31,2 KB
R1-1610666.zip	2016/10/18 20:45	31,3 KB
R1-1610667.zip	2016/10/18 20:45	110,6 KB
R1-1610668.zip	2016/10/18 20:53	56,5 KB
R1-1610669.zip	2016/10/18 20:45	48,5 KB
R1-1610670.zip	2016/10/18 20:45	42,1 KB
R1-1610671.zip	2016/10/18 20:53	101,5 KB
R1-1610672.zip	2016/10/18 20:48	56,4 KB
R1-1610673.zip	2016/10/18 20:48	60,3 KB
R1-1610676.zip	2016/10/18 20:53	38,2 KB
R1-1610677.zip	2016/10/18 20:48	38,2 KB
R1-1610678.zip	2016/10/18 20:48	216,2 KB
R1-1610679.zip	2016/10/18 20:48	15,2 KB
R1-1610680.zip	2016/10/11 23:36	15,6 KB
R1-1610681.zip	2016/10/18 20:48	28,6 KB
R1-1610682.zip	2016/10/18 20:48	296,3 KB
R1-1610683.zip	2016/10/11 23:36	80,7 KB
R1-1610684.zip	2016/10/18 20:47	32,6 KB
R1-1610685.zip	2016/10/11 23:36	41,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610686.zip	2016/10/18 20:47	45,1 KB
R1-1610687.zip	2016/10/18 20:53	386,9 KB
R1-1610688.zip	2016/10/18 20:47	2506,6 KB
R1-1610689.zip	2016/10/18 20:53	59,6 KB
R1-1610690.zip	2016/10/18 20:47	78,4 KB
R1-1610691.zip	2016/10/18 20:47	48,1 KB
R1-1610692.zip	2016/10/18 20:47	192,3 KB
R1-1610693.zip	2016/10/18 20:53	44,5 KB
R1-1610694.zip	2016/10/18 20:47	25,3 KB
R1-1610695.zip	2016/10/18 20:49	49,7 KB
R1-1610696.zip	2016/10/18 20:49	40,3 KB
R1-1610697.zip	2016/10/18 20:49	52,4 KB
R1-1610698.zip	2016/10/18 20:49	41,5 KB
R1-1610699.zip	2016/10/18 20:49	45,6 KB
R1-1610700.zip	2016/10/18 19:25	123,5 KB
R1-1610701.zip	2016/10/18 19:25	42,1 KB
R1-1610702.zip	2016/10/18 19:25	34,2 KB
R1-1610703.zip	2016/10/18 19:25	40,7 KB
R1-1610704.zip	2016/10/18 19:25	28 KB
R1-1610705.zip	2016/10/11 23:36	25,5 KB
R1-1610706.zip	2016/10/18 19:25	44,8 KB
R1-1610707.zip	2016/10/18 19:25	40,5 KB
R1-1610708.zip	2016/10/18 19:25	113,6 KB
R1-1610709.zip	2016/10/18 19:25	95,3 KB
R1-1610710.zip	2016/10/11 23:34	21,2 KB
R1-1610711.zip	2016/10/18 19:25	58,4 KB
R1-1610712.zip	2016/10/18 19:25	412,7 KB
R1-1610713.zip	2016/10/18 19:25	52 KB
R1-1610714.zip	2016/10/18 19:25	45 KB
R1-1610715.zip	2016/10/18 19:25	37,9 KB
R1-1610716.zip	2016/10/11 23:34	34,4 KB
R1-1610717.zip	2016/10/18 19:25	69,8 KB
R1-1610718.zip	2016/10/18 19:25	33,4 KB
R1-1610719.zip	2016/10/11 23:34	59,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610720.zip	2016/10/18 19:25	42,4 KB
R1-1610721.zip	2016/10/18 19:25	32,5 KB
R1-1610722.zip	2016/10/18 19:25	37,1 KB
R1-1610723.zip	2016/10/18 19:25	29 KB
R1-1610724.zip	2016/10/18 19:25	28,5 KB
R1-1610725.zip	2016/10/18 19:25	54,3 KB
R1-1610726.zip	2016/10/18 19:25	29,1 KB
R1-1610727.zip	2016/10/11 23:34	52,4 KB
R1-1610728.zip	2016/10/18 19:25	33,7 KB
R1-1610729.zip	2016/10/18 19:25	36,9 KB
R1-1610730.zip	2016/10/18 19:25	37,4 KB
R1-1610731.zip	2016/10/18 19:25	38,6 KB
R1-1610732.zip	2016/10/18 19:25	36,9 KB
R1-1610733.zip	2016/10/18 19:25	55,3 KB
R1-1610734.zip	2016/10/18 19:25	54,3 KB
R1-1610735.zip	2016/10/18 19:25	58,7 KB
R1-1610736.zip	2016/10/11 23:34	22,4 KB
R1-1610737.zip	2016/10/18 19:25	703 KB
R1-1610739.zip	2016/10/18 19:24	63,5 KB
R1-1610740.zip	2016/10/18 19:24	51,3 KB
R1-1610741.zip	2016/10/18 19:24	80,7 KB
R1-1610742.zip	2016/10/18 19:24	59,2 KB
R1-1610743.zip	2016/10/18 19:24	46 KB
R1-1610744.zip	2016/10/18 19:24	45,6 KB
R1-1610745.zip	2016/10/18 19:24	78,7 KB
R1-1610746.zip	2016/10/18 19:24	55,3 KB
R1-1610747.zip	2016/10/11 23:34	116,7 KB
R1-1610748.zip	2016/10/18 19:24	18,7 KB
R1-1610749.zip	2016/10/18 19:24	29,8 KB
R1-1610750.zip	2016/10/18 19:24	57,8 KB
R1-1610752.zip	2016/10/18 19:24	43,7 KB
R1-1610753.zip	2016/10/18 19:24	47,6 KB
R1-1610754.zip	2016/10/18 19:24	45,7 KB
R1-1610756.zip	2016/10/18 19:24	65,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610757.zip	2016/10/18 19:24	102,3 KB
R1-1610758.zip	2016/10/18 19:24	54,3 KB
R1-1610759.zip	2016/10/18 19:24	53,1 KB
R1-1610760.zip	2016/10/18 19:24	425,4 KB
R1-1610761.zip	2016/10/18 19:24	253 KB
R1-1610762.zip	2016/10/18 19:24	236,9 KB
R1-1610763.zip	2016/10/18 19:24	51,5 KB
R1-1610764.zip	2016/10/18 19:24	48,3 KB
R1-1610765.zip	2016/10/18 19:24	13,2 KB
R1-1610766.zip	2016/10/18 19:24	12,2 KB
R1-1610767.zip	2016/10/18 19:24	42,6 KB
R1-1610768.zip	2016/10/18 19:24	31,3 KB
R1-1610769.zip	2016/10/18 20:53	122,8 KB
R1-1610770.zip	2016/10/18 19:24	128,5 KB
R1-1610771.zip	2016/10/18 19:24	49,4 KB
R1-1610772.zip	2016/10/18 19:24	32,7 KB
R1-1610773.zip	2016/10/18 19:24	28,7 KB
R1-1610774.zip	2016/10/18 19:24	25,1 KB
R1-1610775.zip	2016/10/18 19:24	57,7 KB
R1-1610776.zip	2016/10/18 19:24	45,2 KB
R1-1610777.zip	2016/10/18 19:24	56,2 KB
R1-1610778.zip	2016/10/18 19:24	24,6 KB
R1-1610779.zip	2016/10/18 19:24	20,2 KB
R1-1610780.zip	2016/10/18 11:51	18,7 KB
R1-1610781.zip	2016/10/18 19:24	96,9 KB
R1-1610782.zip	2016/10/18 19:24	43,8 KB
R1-1610783.zip	2016/10/18 19:24	80,5 KB
R1-1610784.zip	2016/10/18 19:24	52,8 KB
R1-1610786.zip	2016/10/18 19:24	38,8 KB
R1-1610787.zip	2016/10/18 19:24	39,3 KB
R1-1610788.zip	2016/10/18 19:24	31,8 KB
R1-1610789.zip	2016/10/18 19:24	361,5 KB
R1-1610790.zip	2016/10/18 19:24	52,6 KB
R1-1610791.zip	2016/10/18 19:24	138,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610792.zip	2016/10/18 19:24	28,7 KB
R1-1610793.zip	2016/10/18 19:24	60,2 KB
R1-1610794.zip	2016/10/18 19:23	44,4 KB
R1-1610796.zip	2016/10/18 19:23	53,7 KB
R1-1610797.zip	2016/10/18 19:23	53,8 KB
R1-1610798.zip	2016/10/18 19:23	13 KB
R1-1610799.zip	2016/10/18 19:23	40,7 KB
R1-1610800.zip	2016/10/18 19:23	28,7 KB
R1-1610801.zip	2016/10/18 19:23	59,2 KB
R1-1610802.zip	2016/10/18 19:23	44,5 KB
R1-1610803.zip	2016/10/18 19:23	29,1 KB
R1-1610804.zip	2016/10/18 19:23	49,4 KB
R1-1610805.zip	2016/10/18 19:23	72,4 KB
R1-1610806.zip	2016/10/18 19:23	46,5 KB
R1-1610807.zip	2016/10/18 19:23	401,3 KB
R1-1610808.zip	2016/10/18 19:23	50,7 KB
R1-1610809.zip	2016/10/18 19:23	39,3 KB
R1-1610810.zip	2016/10/18 19:23	76,9 KB
R1-1610811.zip	2016/10/18 19:23	37 KB
R1-1610812.zip	2016/10/18 19:23	91,9 KB
R1-1610813.zip	2016/10/18 19:23	132,5 KB
R1-1610814.zip	2016/10/18 19:23	37,8 KB
R1-1610815.zip	2016/10/18 19:23	86,5 KB
R1-1610816.zip	2016/10/18 19:23	84,8 KB
R1-1610817.zip	2016/10/18 19:23	30,2 KB
R1-1610818.zip	2016/10/18 19:23	54,1 KB
R1-1610819.zip	2016/10/18 19:23	112,3 KB
R1-1610820.zip	2016/10/18 19:23	32,3 KB
R1-1610821.zip	2016/10/18 19:23	105,6 KB
R1-1610822.zip	2016/10/18 19:23	105,8 KB
R1-1610824.zip	2016/10/18 19:23	28,1 KB
R1-1610825.zip	2016/10/18 19:23	41,2 KB
R1-1610826.zip	2016/10/18 19:23	50,2 KB
R1-1610827.zip	2016/10/18 19:23	61,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610828.zip	2016/10/18 19:23	47,7 KB
R1-1610829.zip	2016/10/18 19:23	61,8 KB
R1-1610830.zip	2016/10/18 19:23	39,4 KB
R1-1610831.zip	2016/10/18 19:23	279,4 KB
R1-1610832.zip	2016/10/18 19:23	39,3 KB
R1-1610833.zip	2016/10/18 19:23	50,2 KB
R1-1610834.zip	2016/10/18 19:23	44,4 KB
R1-1610835.zip	2016/10/18 19:23	57 KB
R1-1610836.zip	2016/10/18 19:23	64,7 KB
R1-1610837.zip	2016/10/18 19:23	30,1 KB
R1-1610838.zip	2016/10/18 19:23	30,1 KB
R1-1610839.zip	2016/10/18 19:23	48,6 KB
R1-1610840.zip	2016/10/18 19:23	88,3 KB
R1-1610841.zip	2016/10/18 19:23	15,3 KB
R1-1610842.zip	2016/10/18 19:23	354,1 KB
R1-1610843.zip	2016/10/18 19:23	342,7 KB
R1-1610844.zip	2016/10/18 19:23	45,9 KB
R1-1610845.zip	2016/10/18 19:23	57,5 KB
R1-1610846.zip	2016/10/18 19:23	49,4 KB
R1-1610847.zip	2016/10/18 19:23	13,9 KB
R1-1610848.zip	2016/10/18 19:23	333,2 KB
R1-1610849.zip	2016/10/18 19:23	30,5 KB
R1-1610850.zip	2016/10/18 19:23	62,4 KB
R1-1610852.zip	2016/10/18 19:23	43 KB
R1-1610853.zip	2016/10/18 19:22	43,2 KB
R1-1610854.zip	2016/10/18 19:22	49,4 KB
R1-1610855.zip	2016/10/18 19:22	38,5 KB
R1-1610856.zip	2016/10/18 19:22	37,7 KB
R1-1610857.zip	2016/10/18 19:22	59,4 KB
R1-1610858.zip	2016/10/18 19:22	64 KB
R1-1610859.zip	2016/10/18 19:22	28,8 KB
R1-1610860.zip	2016/10/18 19:22	46,5 KB
R1-1610861.zip	2016/10/18 19:22	35 KB
R1-1610864.zip	2016/10/18 19:22	108,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610865.zip	2016/10/18 19:22	247,8 KB
R1-1610866.zip	2016/10/18 19:22	93,1 KB
R1-1610867.zip	2016/10/18 19:22	190,9 KB
R1-1610868.zip	2016/10/18 19:22	114,9 KB
R1-1610869.zip	2016/10/18 19:22	92,5 KB
R1-1610870.zip	2017/02/08 13:36	96,2 KB
R1-1610871.zip	2016/10/18 19:22	97,3 KB
R1-1610872.zip	2016/10/18 19:22	129,2 KB
R1-1610873.zip	2016/10/18 19:22	121,1 KB
R1-1610874.zip	2016/10/18 19:22	89,9 KB
R1-1610875.zip	2016/10/18 19:22	85,4 KB
R1-1610876.zip	2016/10/18 19:22	18,1 KB
R1-1610877.zip	2016/10/18 19:22	107 KB
R1-1610878.zip	2016/10/18 19:22	108,4 KB
R1-1610879.zip	2016/10/18 19:22	89,6 KB
R1-1610880.zip	2016/10/18 19:22	91,6 KB
R1-1610881.zip	2016/10/18 19:22	86,1 KB
R1-1610882.zip	2016/10/18 19:22	130,7 KB
R1-1610883.zip	2016/10/18 19:22	362,7 KB
R1-1610884.zip	2016/10/18 19:22	24,9 KB
R1-1610885.zip	2016/10/18 19:22	36,7 KB
R1-1610886.zip	2016/10/18 19:22	28,8 KB
R1-1610887.zip	2016/10/18 19:22	22,2 KB
R1-1610888.zip	2016/10/18 19:22	108,2 KB
R1-1610889.zip	2016/10/18 19:22	61,2 KB
R1-1610890.zip	2016/10/18 19:22	256,7 KB
R1-1610891.zip	2016/10/18 19:22	159,8 KB
R1-1610893.zip	2016/10/18 19:22	324,5 KB
R1-1610894.zip	2016/10/18 19:22	35,2 KB
R1-1610895.zip	2016/10/18 19:22	53,4 KB
R1-1610896.zip	2016/10/18 19:22	30 KB
R1-1610898.zip	2016/10/18 19:22	32,8 KB
R1-1610899.zip	2016/10/18 19:22	58,4 KB
R1-1610900.zip	2016/10/18 19:19	40,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610901.zip	2016/10/18 19:19	64,2 KB
R1-1610902.zip	2016/10/18 19:19	56,7 KB
R1-1610903.zip	2016/10/18 19:19	47,4 KB
R1-1610904.zip	2016/10/18 19:19	217,3 KB
R1-1610905.zip	2016/10/18 19:19	41,8 KB
R1-1610906.zip	2016/10/18 19:19	26,4 KB
R1-1610907.zip	2016/10/18 19:19	26,1 KB
R1-1610908.zip	2016/10/18 19:19	25 KB
R1-1610909.zip	2016/10/18 19:19	55,3 KB
R1-1610910.zip	2016/10/18 19:19	39,5 KB
R1-1610911.zip	2016/10/18 19:19	59,3 KB
R1-1610912.zip	2016/10/18 19:19	59,2 KB
R1-1610913.zip	2016/10/18 19:19	105 KB
R1-1610914.zip	2016/10/18 19:19	56,1 KB
R1-1610915.zip	2016/10/18 19:19	56,2 KB
R1-1610916.zip	2016/10/18 19:19	65,1 KB
R1-1610917.zip	2016/10/18 19:19	65,1 KB
R1-1610918.zip	2016/10/18 19:19	519,9 KB
R1-1610919.zip	2016/10/18 19:19	70,1 KB
R1-1610920.zip	2016/10/18 19:19	14,6 KB
R1-1610921.zip	2016/10/18 19:19	36,5 KB
R1-1610922.zip	2016/10/18 19:19	29,5 KB
R1-1610923.zip	2016/10/18 19:19	31,6 KB
R1-1610924.zip	2016/10/18 19:19	46 KB
R1-1610925.zip	2016/10/18 19:19	414,7 KB
R1-1610926.zip	2016/10/18 19:18	24,7 KB
R1-1610927.zip	2016/10/18 19:18	147,2 KB
R1-1610928.zip	2016/10/18 19:18	50,1 KB
R1-1610929.zip	2016/10/18 11:51	13,9 KB
R1-1610930.zip	2016/10/18 11:51	14,6 KB
R1-1610931.zip	2016/10/18 19:18	843,2 KB
R1-1610932.zip	2016/10/18 19:18	31,4 KB
R1-1610934.zip	2016/10/18 19:18	39,6 KB
R1-1610935.zip	2016/10/18 19:18	88,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610936.zip	2016/10/18 19:18	109,8 KB
R1-1610937.zip	2016/10/18 19:18	52,4 KB
R1-1610938.zip	2016/10/18 19:18	87 KB
R1-1610939.zip	2016/10/18 19:18	28,6 KB
R1-1610940.zip	2016/10/18 19:18	267,3 KB
R1-1610941.zip	2016/10/18 19:18	39,3 KB
R1-1610942.zip	2016/10/18 19:18	49,6 KB
R1-1610943.zip	2016/10/18 19:18	17,5 KB
R1-1610944.zip	2016/10/18 19:18	30,2 KB
R1-1610945.zip	2016/10/18 19:18	30,1 KB
R1-1610946.zip	2016/10/18 19:18	34,3 KB
R1-1610947.zip	2016/10/18 19:18	59,8 KB
R1-1610948.zip	2016/10/18 19:18	55,3 KB
R1-1610949.zip	2016/10/18 19:18	56,6 KB
R1-1610950.zip	2016/10/18 19:18	56,6 KB
R1-1610951.zip	2016/10/18 19:18	40,8 KB
R1-1610952.zip	2016/10/18 19:18	37,5 KB
R1-1610953.zip	2016/10/18 19:18	71,7 KB
R1-1610954.zip	2016/10/18 19:18	40 KB
R1-1610955.zip	2016/10/18 19:18	28,3 KB
R1-1610956.zip	2016/10/18 19:18	66,8 KB
R1-1610957.zip	2016/10/18 19:18	59,6 KB
R1-1610958.zip	2016/10/18 19:18	70,7 KB
R1-1610959.zip	2016/10/18 19:18	48,8 KB
R1-1610960.zip	2016/10/18 19:18	23,9 KB
R1-1610961.zip	2016/10/18 19:18	37,5 KB
R1-1610962.zip	2016/10/18 19:18	32,9 KB
R1-1610964.zip	2016/10/18 19:18	31,6 KB
R1-1610965.zip	2016/10/18 19:18	36,8 KB
R1-1610966.zip	2016/10/18 19:18	12,9 KB
R1-1610967.zip	2016/10/18 19:18	33,4 KB
R1-1610968.zip	2016/10/18 19:18	31,6 KB
R1-1610969.zip	2016/10/18 19:18	20,6 KB
R1-1610970.zip	2016/10/18 19:18	19,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1610971.zip	2016/10/18 19:18	30,9 KB
R1-1610972.zip	2016/10/18 19:18	11,2 KB
R1-1610973.zip	2016/10/18 19:18	45 KB
R1-1610974.zip	2016/10/18 19:18	42,8 KB
R1-1610975.zip	2016/10/18 19:18	38,2 KB
R1-1610976.zip	2016/10/18 19:18	27,8 KB
R1-1610977.zip	2016/10/18 19:18	37 KB
R1-1610978.zip	2016/10/18 19:18	55,8 KB
R1-1610979.zip	2016/10/18 19:18	13,7 KB
R1-1610980.zip	2016/10/18 19:18	40,5 KB
R1-1610981.zip	2016/10/18 19:18	348,7 KB
R1-1610982.zip	2016/10/18 19:18	47,6 KB
R1-1610983.zip	2016/10/18 19:18	32,5 KB
R1-1610984.zip	2016/10/24 7:47	46,5 KB
R1-1610985.zip	2016/10/18 19:18	28,2 KB
R1-1610986.zip	2016/10/18 19:17	27,9 KB
R1-1610987.zip	2016/10/18 19:17	48,8 KB
R1-1610990.zip	2016/10/18 19:17	13,9 KB
R1-1610991.zip	2016/10/18 19:12	31,3 KB
R1-1610992.zip	2016/10/18 11:51	13,8 KB
R1-1610993.zip	2016/10/18 19:12	345,5 KB
R1-1610994.zip	2016/10/18 19:12	107,3 KB
R1-1610995.zip	2016/10/18 19:12	407,2 KB
R1-1610996.zip	2016/10/18 19:12	32 KB
R1-1610998.zip	2016/10/18 19:12	46,5 KB
R1-1610999.zip	2016/10/18 19:12	47,5 KB
R1-1611000.zip	2016/10/18 11:51	12,9 KB
R1-1611005.zip	2016/10/18 19:12	38,3 KB
R1-1611006.zip	2016/10/18 19:12	20,7 KB
R1-1611007.zip	2016/10/18 19:12	25,5 KB
R1-1611008.zip	2016/10/18 19:12	107,7 KB
R1-1611009.zip	2016/10/18 19:12	22,2 KB
R1-1611010.zip	2016/10/18 19:12	67,5 KB
R1-1611011.zip	2016/10/18 19:12	56,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611012.zip	2016/10/18 19:12	65,8 KB
R1-1611013.zip	2016/10/18 19:12	52 KB
R1-1611014.zip	2016/10/18 19:12	41 KB
R1-1611015.zip	2016/10/18 19:12	28,3 KB
R1-1611016.zip	2016/10/18 19:12	64,1 KB
R1-1611017.zip	2016/10/18 19:12	11,3 KB
R1-1611018.zip	2016/10/18 19:12	33,6 KB
R1-1611019.zip	2016/10/18 19:12	29,8 KB
R1-1611020.zip	2016/10/18 19:12	4682,7 KB
R1-1611021.zip	2016/10/18 19:11	51,9 KB
R1-1611022.zip	2016/10/18 19:11	32,1 KB
R1-1611023.zip	2016/10/18 19:11	79,9 KB
R1-1611024.zip	2016/10/18 19:11	47,4 KB
R1-1611025.zip	2016/10/18 19:11	51,9 KB
R1-1611026.zip	2016/10/18 11:51	93,1 KB
R1-1611027.zip	2016/10/18 19:11	48,8 KB
R1-1611028.zip	2016/10/18 19:11	48,8 KB
R1-1611029.zip	2016/10/18 19:11	28,7 KB
R1-1611030.zip	2016/10/18 19:11	28,7 KB
R1-1611031.zip	2016/10/18 11:51	16,2 KB
R1-1611032.zip	2016/10/18 11:51	20,6 KB
R1-1611033.zip	2016/10/18 11:51	20,5 KB
R1-1611034.zip	2016/10/18 11:51	20,1 KB
R1-1611035.zip	2016/10/18 19:11	42,1 KB
R1-1611036.zip	2016/10/18 19:11	47 KB
R1-1611037.zip	2016/10/18 19:11	37,5 KB
R1-1611038.zip	2016/10/18 19:11	31,4 KB
R1-1611039.zip	2016/10/18 19:11	20,1 KB
R1-1611040.zip	2016/10/18 19:11	23,7 KB
R1-1611041.zip	2016/10/18 19:11	190,3 KB
R1-1611042.zip	2016/10/18 19:11	39 KB
R1-1611044.zip	2016/10/18 19:11	49,5 KB
R1-1611045.zip	2016/10/18 19:11	64,3 KB
R1-1611046.zip	2016/10/18 19:11	42,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611047.zip	2016/10/18 19:11	58,2 KB
R1-1611048.zip	2016/10/18 19:11	101,7 KB
R1-1611049.zip	2016/10/18 11:51	22,2 KB
R1-1611050.zip	2016/10/18 11:51	38,1 KB
R1-1611051.zip	2016/10/18 11:51	130 KB
R1-1611052.zip	2016/10/18 11:51	11,2 KB
R1-1611053.zip	2016/10/18 11:51	11,2 KB
R1-1611054.zip	2016/10/18 11:51	8,4 KB
R1-1611055.zip	2016/10/18 11:51	23,4 KB
R1-1611056.zip	2016/10/18 11:51	28,2 KB
R1-1611057.zip	2016/10/18 11:51	15 KB
R1-1611058.zip	2016/10/18 19:11	49,8 KB
R1-1611059.zip	2016/10/18 19:11	117 KB
R1-1611060.zip	2016/10/18 19:11	165,9 KB
R1-1611061.zip	2016/10/18 19:11	22,7 KB
R1-1611062.zip	2016/10/18 19:11	147,7 KB
R1-1611063.zip	2016/10/18 19:11	140,8 KB
R1-1611064.zip	2016/10/18 19:11	59,3 KB
R1-1611065.zip	2016/10/18 19:11	194,5 KB
R1-1611066.zip	2016/10/18 11:51	22,7 KB
R1-1611067.zip	2016/10/18 20:12	50,5 KB
R1-1611068.zip	2016/10/19 9:26	87,8 KB
R1-1611069.zip	2016/11/03 17:27	322,4 KB
R1-1611070.zip	2016/11/03 7:03	22,1 KB
R1-1611071.zip	2016/10/31 11:23	2381,9 KB
R1-1611072.zip	2016/11/04 13:45	43,3 KB
R1-1611073.zip	2016/11/08 10:02	42 KB
R1-1611074.zip	2016/11/04 13:45	44 KB
TDoc_List_Meeting_RAN1#86-BIS.xlsm	2017/02/28 4:38	560,5 KB
TDoc_List_Meeting_RAN1#86-BIS.xlsx	2022/01/10 15:29	558 KB
TDoc_List_Meeting_RAN1#86-BIS.zip	2018/01/10 16:44	995,2 KB

2441 items.

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APPENDIX 24

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611080.zip	2016/11/02 8:22	85,9 KB
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R1-1611083.zip	2016/11/02 8:22	12,5 KB
R1-1611084.zip	2016/11/02 8:22	12,8 KB
R1-1611085.zip	2016/11/02 8:22	16,6 KB
R1-1611086.zip	2016/11/02 8:22	8,5 KB
R1-1611087.zip	2016/11/02 8:22	15,6 KB
R1-1611088.zip	2016/11/02 8:22	27 KB
R1-1611089.zip	2016/11/02 8:22	11,7 KB
R1-1611090.zip	2016/11/02 8:22	11,4 KB
R1-1611091.zip	2016/11/02 8:22	14,2 KB
R1-1611092.zip	2016/11/02 8:22	12 KB
R1-1611093.zip	2016/11/02 8:22	15,6 KB
R1-1611094.zip	2016/11/02 8:22	15 KB
R1-1611095.zip	2016/11/05 9:42	28,1 KB
R1-1611096.zip	2016/11/05 9:42	64,6 KB
R1-1611097.zip	2016/11/05 10:09	28,1 KB
R1-1611098.zip	2016/11/05 10:09	38,1 KB
R1-1611099.zip	2016/11/05 10:53	87,5 KB
R1-1611100.zip	2016/11/05 21:28	95,2 KB
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R1-1611102.zip	2016/11/05 10:09	43 KB
R1-1611103.zip	2016/11/05 10:35	120,4 KB
R1-1611104.zip	2016/11/05 10:35	151,8 KB
R1-1611105.zip	2016/11/05 21:28	225,4 KB
R1-1611106.zip	2016/11/05 21:28	142 KB
R1-1611107.zip	2016/11/05 3:23	142,9 KB
R1-1611108.zip	2016/11/05 3:23	168,7 KB
R1-1611109.zip	2016/11/05 3:23	317,5 KB

sort by name/desc	sort by date/desc	sort by size/desc
R1-1611110.zip	2016/11/05 3:24	167,3 KB
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R1-1611112.zip	2016/11/05 3:24	810,7 KB
R1-1611113.zip	2016/11/05 3:25	348 KB
R1-1611114.zip	2016/11/05 3:25	100,8 KB
R1-1611115.zip	2016/11/05 3:25	311,2 KB
R1-1611116.zip	2016/11/04 19:00	112,6 KB
R1-1611117.zip	2016/11/04 19:00	102,7 KB
R1-1611118.zip	2016/11/04 19:00	71,9 KB
R1-1611119.zip	2016/11/04 19:00	44,3 KB
R1-1611120.zip	2016/11/04 19:00	25,1 KB
R1-1611121.zip	2016/11/04 19:15	60,6 KB
R1-1611122.zip	2016/11/04 19:24	65,8 KB
R1-1611123.zip	2016/11/04 19:09	131,8 KB
R1-1611124.zip	2016/11/04 19:12	34,8 KB
R1-1611126.zip	2016/11/04 19:00	81,2 KB
R1-1611127.zip	2016/11/04 19:00	91,6 KB
R1-1611128.zip	2016/11/05 3:23	54,3 KB
R1-1611129.zip	2016/11/05 3:23	83,5 KB
R1-1611130.zip	2016/11/05 3:23	118 KB
R1-1611131.zip	2016/11/05 3:23	62,8 KB
R1-1611132.zip	2016/11/05 3:23	87,3 KB
R1-1611133.zip	2016/11/05 3:23	89 KB
R1-1611134.zip	2016/11/05 3:23	168,6 KB
R1-1611135.zip	2016/11/05 3:23	51,7 KB
R1-1611136.zip	2016/11/05 3:23	229,7 KB
R1-1611137.zip	2016/11/05 3:23	148,5 KB
R1-1611138.zip	2016/11/05 3:23	70,6 KB
R1-1611139.zip	2016/11/05 3:23	344,3 KB
R1-1611140.zip	2016/11/05 3:23	91,8 KB
R1-1611141.zip	2016/11/05 3:23	95,3 KB
R1-1611142.zip	2016/11/05 3:23	35,6 KB
R1-1611143.zip	2016/11/05 3:23	120,4 KB
R1-1611144.zip	2016/11/05 3:23	60,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611145.zip	2016/11/05 3:23	241,1 KB
R1-1611146.zip	2016/11/05 3:23	33,2 KB
R1-1611147.zip	2016/11/05 3:23	177,2 KB
R1-1611148.zip	2016/11/05 3:23	82,8 KB
R1-1611149.zip	2016/11/05 3:23	189,5 KB
R1-1611150.zip	2016/11/05 3:23	103,6 KB
R1-1611151.zip	2016/11/05 3:25	114,9 KB
R1-1611152.zip	2016/11/05 3:25	128 KB
R1-1611153.zip	2016/11/05 3:25	84,3 KB
R1-1611154.zip	2016/11/05 3:25	495,2 KB
R1-1611155.zip	2016/11/05 3:25	70,1 KB
R1-1611156.zip	2016/11/05 3:25	231,8 KB
R1-1611157.zip	2016/11/05 3:25	86,4 KB
R1-1611158.zip	2016/11/05 3:25	151,7 KB
R1-1611159.zip	2016/11/05 3:25	279,9 KB
R1-1611160.zip	2016/11/05 3:25	183,7 KB
R1-1611161.zip	2016/11/05 3:25	107,4 KB
R1-1611162.zip	2016/11/05 3:25	97,8 KB
R1-1611163.zip	2016/11/05 3:25	48 KB
R1-1611164.zip	2016/11/05 3:25	182,1 KB
R1-1611165.zip	2016/11/05 3:25	95,6 KB
R1-1611166.zip	2016/11/05 3:25	45 KB
R1-1611167.zip	2016/11/05 3:25	123,2 KB
R1-1611168.zip	2016/11/05 3:25	80,3 KB
R1-1611169.zip	2016/11/05 3:25	108,2 KB
R1-1611170.zip	2016/11/05 3:25	104,7 KB
R1-1611171.zip	2016/11/05 3:25	45,9 KB
R1-1611172.zip	2016/11/05 3:25	29,6 KB
R1-1611173.zip	2016/11/05 3:25	88,3 KB
R1-1611174.zip	2016/11/05 3:25	48,1 KB
R1-1611175.zip	2016/11/05 3:25	56,6 KB
R1-1611176.zip	2016/11/05 3:25	184,1 KB
R1-1611177.zip	2016/11/05 3:25	124,9 KB
R1-1611178.zip	2016/11/05 3:25	226,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611179.zip	2016/11/05 3:25	106 KB
R1-1611180.zip	2016/11/05 3:25	36,6 KB
R1-1611181.zip	2016/11/05 3:26	44,2 KB
R1-1611182.zip	2016/11/05 3:26	41,1 KB
R1-1611183.zip	2016/11/05 3:26	70,4 KB
R1-1611184.zip	2016/11/05 3:26	42,5 KB
R1-1611185.zip	2016/11/05 3:26	139,8 KB
R1-1611186.zip	2016/11/05 3:26	82,4 KB
R1-1611187.zip	2016/11/05 3:26	178,9 KB
R1-1611188.zip	2016/11/05 3:26	46,4 KB
R1-1611189.zip	2016/11/05 3:26	141,4 KB
R1-1611190.zip	2016/11/05 3:26	103 KB
R1-1611191.zip	2016/11/05 3:26	75,2 KB
R1-1611192.zip	2016/11/05 3:26	240 KB
R1-1611193.zip	2016/11/05 3:26	396,7 KB
R1-1611194.zip	2016/11/05 3:26	89,8 KB
R1-1611195.zip	2016/11/05 3:26	80,8 KB
R1-1611196.zip	2016/11/05 4:39	299,2 KB
R1-1611197.zip	2016/11/05 4:39	334,8 KB
R1-1611198.zip	2016/11/05 4:39	142,3 KB
R1-1611199.zip	2016/11/05 4:39	104,6 KB
R1-1611200.zip	2016/11/05 4:39	121,1 KB
R1-1611201.zip	2016/11/05 4:39	150,2 KB
R1-1611202.zip	2016/11/05 4:39	206 KB
R1-1611203.zip	2016/11/05 4:39	79,4 KB
R1-1611204.zip	2016/11/05 4:39	136,4 KB
R1-1611205.zip	2016/11/05 4:41	315 KB
R1-1611206.zip	2016/11/05 4:41	144,4 KB
R1-1611207.zip	2016/11/05 4:41	259,1 KB
R1-1611208.zip	2016/11/05 4:41	93 KB
R1-1611209.zip	2016/11/05 15:21	323 KB
R1-1611210.zip	2016/11/05 4:41	225,2 KB
R1-1611211.zip	2016/11/05 4:41	88,6 KB
R1-1611212.zip	2016/11/05 4:41	53,6 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1611213.zip	2016/11/05 4:41	79,2 KB
R1-1611214.zip	2016/11/05 4:39	154,6 KB
R1-1611215.zip	2016/11/05 4:41	85,3 KB
R1-1611216.zip	2016/11/05 4:41	84,3 KB
R1-1611217.zip	2016/11/05 4:41	31 KB
R1-1611218.zip	2016/11/05 4:41	208,4 KB
R1-1611219.zip	2016/11/05 8:56	222,8 KB
R1-1611220.zip	2016/11/05 8:56	416,1 KB
R1-1611221.zip	2016/11/05 4:39	274,7 KB
R1-1611222.zip	2016/11/05 8:56	164,2 KB
R1-1611223.zip	2016/11/06 3:02	239,6 KB
R1-1611224.zip	2016/11/05 4:39	284,4 KB
R1-1611225.zip	2016/11/05 4:39	192,3 KB
R1-1611226.zip	2016/11/05 4:39	254 KB
R1-1611227.zip	2016/11/05 4:39	238 KB
R1-1611228.zip	2016/11/05 4:39	349,4 KB
R1-1611229.zip	2016/11/05 4:39	53,1 KB
R1-1611230.zip	2016/11/05 4:39	271,3 KB
R1-1611231.zip	2016/11/05 4:39	180,7 KB
R1-1611232.zip	2016/11/05 4:39	173,7 KB
R1-1611233.zip	2016/11/05 4:39	205,6 KB
R1-1611234.zip	2016/11/05 4:39	48,4 KB
R1-1611235.zip	2016/11/05 4:39	347,2 KB
R1-1611236.zip	2016/11/05 4:39	223,7 KB
R1-1611237.zip	2016/11/05 4:40	150,4 KB
R1-1611238.zip	2016/11/05 4:40	104,8 KB
R1-1611239.zip	2016/11/05 4:41	616,2 KB
R1-1611240.zip	2016/11/05 4:41	239 KB
R1-1611241.zip	2016/11/05 4:41	131,9 KB
R1-1611242.zip	2016/11/05 4:41	275,2 KB
R1-1611243.zip	2016/11/05 15:21	33,8 KB
R1-1611244.zip	2016/11/05 4:41	81,2 KB
R1-1611245.zip	2016/11/05 4:41	35,7 KB
R1-1611246.zip	2016/11/05 4:41	362,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611247.zip	2016/11/05 4:40	51,5 KB
R1-1611248.zip	2016/11/05 4:40	93,5 KB
R1-1611249.zip	2016/11/05 4:41	32,6 KB
R1-1611250.zip	2016/11/05 4:41	76,5 KB
R1-1611251.zip	2016/11/05 4:41	241,6 KB
R1-1611252.zip	2016/11/05 4:40	187,3 KB
R1-1611253.zip	2016/11/05 5:24	70,1 KB
R1-1611254.zip	2016/11/03 6:25	1496,3 KB
R1-1611255.zip	2016/11/03 6:25	3452,5 KB
R1-1611256.zip	2016/11/05 5:24	4347,6 KB
R1-1611257.zip	2016/11/05 5:24	1479,1 KB
R1-1611258.zip	2016/11/05 5:24	427,7 KB
R1-1611259.zip	2016/11/05 5:24	170,3 KB
R1-1611260.zip	2016/11/05 5:24	731,4 KB
R1-1611261.zip	2016/11/05 4:41	482,7 KB
R1-1611262.zip	2016/11/04 20:28	166,8 KB
R1-1611263.zip	2016/11/04 20:28	125,9 KB
R1-1611264.zip	2016/11/04 20:28	100,9 KB
R1-1611265.zip	2016/11/04 20:28	101 KB
R1-1611266.zip	2016/11/04 14:43	228 KB
R1-1611267.zip	2016/11/05 7:24	237,4 KB
R1-1611268.zip	2016/11/05 7:24	107,7 KB
R1-1611269.zip	2016/11/05 7:24	323,7 KB
R1-1611270.zip	2016/11/05 7:24	127,1 KB
R1-1611271.zip	2016/11/05 7:24	172,1 KB
R1-1611272.zip	2016/11/05 7:25	223,3 KB
R1-1611273.zip	2016/11/05 7:25	145,3 KB
R1-1611274.zip	2016/11/05 7:25	79,8 KB
R1-1611275.zip	2016/11/05 7:25	37,2 KB
R1-1611276.zip	2016/11/05 7:25	42,3 KB
R1-1611277.zip	2016/11/05 7:25	288,9 KB
R1-1611278.zip	2016/11/04 19:02	44,7 KB
R1-1611279.zip	2016/11/04 19:02	53,7 KB
R1-1611280.zip	2016/11/04 19:02	119,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611281.zip	2016/11/04 19:02	222,4 KB
R1-1611282.zip	2016/11/04 19:02	47,9 KB
R1-1611283.zip	2016/11/04 19:02	132,6 KB
R1-1611284.zip	2016/11/03 1:16	253,9 KB
R1-1611285.zip	2016/11/05 6:34	620,9 KB
R1-1611286.zip	2016/11/05 6:34	122,8 KB
R1-1611287.zip	2016/11/05 6:35	171,1 KB
R1-1611288.zip	2016/11/05 6:35	128,4 KB
R1-1611289.zip	2016/11/05 6:35	349,4 KB
R1-1611290.zip	2016/11/05 6:46	93,3 KB
R1-1611291.zip	2016/11/05 6:46	331,7 KB
R1-1611292.zip	2016/11/05 6:46	130,2 KB
R1-1611293.zip	2016/11/05 6:46	39,4 KB
R1-1611294.zip	2016/11/05 6:47	40,8 KB
R1-1611295.zip	2016/11/05 6:47	132,1 KB
R1-1611296.zip	2016/11/06 3:11	184,7 KB
R1-1611297.zip	2016/11/05 3:16	55,9 KB
R1-1611298.zip	2016/11/05 3:16	46,6 KB
R1-1611299.zip	2016/11/11 10:29	27,7 KB
R1-1611300.zip	2016/11/11 10:29	46,9 KB
R1-1611301.zip	2016/11/05 10:16	34,9 KB
R1-1611302.zip	2016/11/05 10:16	48,9 KB
R1-1611303.zip	2016/11/05 10:16	25,2 KB
R1-1611304.zip	2016/11/05 10:16	29,9 KB
R1-1611305.zip	2016/11/05 10:16	44,2 KB
R1-1611306.zip	2016/11/05 5:25	30,4 KB
R1-1611307.zip	2016/11/04 18:33	40 KB
R1-1611308.zip	2016/11/04 18:33	30,2 KB
R1-1611309.zip	2016/11/04 18:33	39,9 KB
R1-1611310.zip	2016/11/04 18:33	48,4 KB
R1-1611311.zip	2016/11/04 18:33	55,7 KB
R1-1611312.zip	2016/11/05 5:25	31,3 KB
R1-1611313.zip	2016/11/04 18:33	30,7 KB
R1-1611314.zip	2016/11/04 18:33	36,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611315.zip	2016/11/05 21:28	55,5 KB
R1-1611316.zip	2016/11/06 5:11	408,9 KB
R1-1611317.zip	2016/11/06 5:11	300,4 KB
R1-1611318.zip	2016/11/06 5:11	64,8 KB
R1-1611319.zip	2016/11/06 5:11	30,9 KB
R1-1611320.zip	2016/11/06 5:11	55,1 KB
R1-1611321.zip	2016/11/06 5:11	646,6 KB
R1-1611322.zip	2016/11/06 5:11	137,1 KB
R1-1611323.zip	2016/11/06 5:11	182,7 KB
R1-1611324.zip	2016/11/06 5:11	220,3 KB
R1-1611325.zip	2016/11/06 5:11	1243,2 KB
R1-1611326.zip	2016/11/06 7:05	924,1 KB
R1-1611327.zip	2016/11/06 5:11	161,1 KB
R1-1611328.zip	2016/11/05 3:12	75 KB
R1-1611329.zip	2016/11/05 3:12	119,2 KB
R1-1611330.zip	2016/11/05 3:12	165,8 KB
R1-1611331.zip	2016/11/05 3:12	100,2 KB
R1-1611332.zip	2016/11/05 3:12	36,1 KB
R1-1611333.zip	2016/11/05 3:12	124,5 KB
R1-1611334.zip	2016/11/05 3:12	73,9 KB
R1-1611335.zip	2016/11/05 3:12	580,3 KB
R1-1611336.zip	2016/11/05 3:12	184,2 KB
R1-1611337.zip	2016/11/05 3:13	471,5 KB
R1-1611338.zip	2016/11/05 3:13	119,1 KB
R1-1611339.zip	2016/11/05 3:14	1335,6 KB
R1-1611340.zip	2016/11/05 3:14	22,5 KB
R1-1611341.zip	2016/11/05 3:14	101,1 KB
R1-1611342.zip	2016/11/05 3:14	145,3 KB
R1-1611343.zip	2016/11/05 3:14	18,3 KB
R1-1611344.zip	2016/11/05 3:14	18,6 KB
R1-1611345.zip	2016/11/05 3:14	65,8 KB
R1-1611346.zip	2016/11/05 3:14	71,2 KB
R1-1611347.zip	2016/11/05 3:14	54,4 KB
R1-1611348.zip	2016/11/05 3:14	140,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611349.zip	2016/11/05 3:06	653,8 KB
R1-1611350.zip	2016/11/05 3:07	428,5 KB
R1-1611351.zip	2016/11/05 3:07	43,4 KB
R1-1611352.zip	2016/11/05 3:07	44,5 KB
R1-1611353.zip	2016/11/05 3:07	41,4 KB
R1-1611354.zip	2016/11/05 3:07	50,6 KB
R1-1611355.zip	2016/11/05 3:07	50,5 KB
R1-1611356.zip	2016/11/05 3:07	50,8 KB
R1-1611357.zip	2016/11/05 3:08	1471,5 KB
R1-1611358.zip	2016/11/05 3:08	736,8 KB
R1-1611359.zip	2016/11/05 3:08	127,7 KB
R1-1611360.zip	2016/11/05 3:08	90,2 KB
R1-1611361.zip	2016/11/05 3:08	79,8 KB
R1-1611362.zip	2016/11/05 7:45	171,5 KB
R1-1611363.zip	2016/11/05 3:08	68,7 KB
R1-1611364.zip	2016/11/05 3:08	76,1 KB
R1-1611365.zip	2016/11/05 3:08	68,2 KB
R1-1611366.zip	2016/11/05 3:20	78,9 KB
R1-1611367.zip	2016/11/05 3:09	64,1 KB
R1-1611368.zip	2016/11/05 3:09	63,8 KB
R1-1611369.zip	2016/11/05 3:09	63,1 KB
R1-1611370.zip	2016/11/05 3:09	64,3 KB
R1-1611371.zip	2016/11/05 3:09	57,6 KB
R1-1611372.zip	2016/11/05 7:46	137 KB
R1-1611373.zip	2016/11/05 3:09	59,1 KB
R1-1611374.zip	2016/11/05 3:09	176,2 KB
R1-1611375.zip	2016/11/05 3:09	330,5 KB
R1-1611376.zip	2016/11/05 3:09	40,4 KB
R1-1611377.zip	2016/11/05 3:09	173,4 KB
R1-1611378.zip	2016/11/05 3:10	288,5 KB
R1-1611379.zip	2016/11/05 3:10	62,5 KB
R1-1611380.zip	2016/11/05 3:10	53,4 KB
R1-1611381.zip	2016/11/05 3:10	53,9 KB
R1-1611382.zip	2016/11/05 3:10	53,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611383.zip	2016/11/05 3:10	34,5 KB
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R1-1611385.zip	2016/11/05 3:10	214,8 KB
R1-1611386.zip	2016/11/05 3:10	112,3 KB
R1-1611387.zip	2016/11/05 3:10	64,9 KB
R1-1611388.zip	2016/11/05 3:10	62,1 KB
R1-1611389.zip	2016/11/05 3:10	63,6 KB
R1-1611390.zip	2016/11/05 3:27	54,2 KB
R1-1611391.zip	2016/11/05 3:27	30,7 KB
R1-1611392.zip	2016/11/05 3:27	30,7 KB
R1-1611393.zip	2016/11/05 3:26	154 KB
R1-1611394.zip	2016/11/05 3:10	103,2 KB
R1-1611395.zip	2016/11/05 3:10	45,9 KB
R1-1611396.zip	2016/11/05 3:10	108,7 KB
R1-1611397.zip	2016/11/05 3:10	20,4 KB
R1-1611398.zip	2016/11/05 3:11	296,3 KB
R1-1611399.zip	2016/11/05 3:11	81,8 KB
R1-1611400.zip	2016/11/05 3:11	43,9 KB
R1-1611401.zip	2016/11/05 3:11	766,2 KB
R1-1611402.zip	2016/11/05 3:11	181,4 KB
R1-1611403.zip	2016/11/05 3:11	92,9 KB
R1-1611404.zip	2016/11/05 3:11	44,2 KB
R1-1611405.zip	2016/11/05 3:11	49,5 KB
R1-1611406.zip	2016/11/05 21:39	844 KB
R1-1611407.zip	2016/11/05 21:39	230 KB
R1-1611409.zip	2016/11/05 21:39	184,4 KB
R1-1611410.zip	2016/11/05 21:38	87,1 KB
R1-1611411.zip	2016/11/06 2:45	159,8 KB
R1-1611412.zip	2016/11/05 21:38	183,6 KB
R1-1611413.zip	2016/11/05 21:38	305,5 KB
R1-1611414.zip	2016/11/06 3:45	95,2 KB
R1-1611415.zip	2016/11/05 21:38	231,9 KB
R1-1611416.zip	2016/11/05 21:39	560,4 KB
R1-1611417.zip	2016/11/05 21:39	160,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611418.zip	2016/11/05 21:39	107,2 KB
R1-1611419.zip	2016/11/05 21:39	138,4 KB
R1-1611420.zip	2016/11/05 21:39	4487,2 KB
R1-1611421.zip	2016/11/05 21:39	120,8 KB
R1-1611422.zip	2016/11/06 2:45	38,3 KB
R1-1611423.zip	2016/11/06 2:45	232,3 KB
R1-1611424.zip	2016/11/06 2:45	102,1 KB
R1-1611425.zip	2016/11/06 2:45	257,7 KB
R1-1611426.zip	2016/11/05 19:52	223,9 KB
R1-1611427.zip	2016/11/05 19:52	83,4 KB
R1-1611428.zip	2016/11/05 19:52	34,5 KB
R1-1611429.zip	2016/11/05 19:52	53,1 KB
R1-1611430.zip	2016/11/05 19:52	1063,8 KB
R1-1611431.zip	2016/11/05 19:52	28,4 KB
R1-1611432.zip	2016/11/05 19:52	74,6 KB
R1-1611433.zip	2016/11/05 19:52	33,2 KB
R1-1611434.zip	2016/11/05 19:52	37,1 KB
R1-1611435.zip	2016/11/05 19:52	60,8 KB
R1-1611436.zip	2016/11/06 5:24	44,5 KB
R1-1611437.zip	2016/11/05 21:00	148,9 KB
R1-1611438.zip	2016/11/05 21:00	57,6 KB
R1-1611439.zip	2016/11/05 21:00	120,2 KB
R1-1611440.zip	2016/11/05 21:00	196,1 KB
R1-1611441.zip	2016/11/05 21:00	271,9 KB
R1-1611442.zip	2016/11/04 15:07	33,7 KB
R1-1611443.zip	2016/11/05 7:26	44,1 KB
R1-1611444.zip	2016/11/02 8:22	31 KB
R1-1611445.zip	2016/11/02 8:22	15,5 KB
R1-1611446.zip	2016/11/02 8:22	12,3 KB
R1-1611447.zip	2016/11/02 8:22	17,2 KB
R1-1611448.zip	2016/11/02 8:22	13,2 KB
R1-1611449.zip	2016/11/02 8:22	10,3 KB
R1-1611450.zip	2016/11/02 8:22	9,7 KB
R1-1611451.zip	2016/11/02 8:22	29,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1611452.zip	2016/11/13 2:38	10,2 KB
R1-1611453.zip	2016/11/02 8:22	86,6 KB
R1-1611454.zip	2016/11/05 0:04	102,6 KB
R1-1611455.zip	2016/11/05 0:04	230,1 KB
R1-1611456.zip	2016/11/05 0:04	156,5 KB
R1-1611457.zip	2016/11/05 0:04	137,8 KB
R1-1611458.zip	2016/11/04 18:15	70,4 KB
R1-1611459.zip	2016/11/04 18:14	334,3 KB
R1-1611460.zip	2016/11/04 18:14	108,7 KB
R1-1611461.zip	2016/11/04 18:14	242 KB
R1-1611462.zip	2016/11/04 18:15	949,5 KB
R1-1611463.zip	2016/11/04 18:15	204,2 KB
R1-1611464.zip	2016/11/04 18:15	139,8 KB
R1-1611465.zip	2016/11/04 18:15	48,8 KB
R1-1611466.zip	2016/11/04 18:15	341,5 KB
R1-1611467.zip	2016/11/04 18:15	472,3 KB
R1-1611468.zip	2016/11/05 0:04	43,3 KB
R1-1611469.zip	2016/11/05 0:04	151,4 KB
R1-1611470.zip	2016/11/05 0:04	345 KB
R1-1611471.zip	2016/11/05 0:04	158,1 KB
R1-1611472.zip	2016/11/05 0:04	153,3 KB
R1-1611473.zip	2016/11/05 0:04	183,1 KB
R1-1611474.zip	2016/11/06 3:17	358,9 KB
R1-1611476.zip	2016/11/04 13:52	83,4 KB
R1-1611477.zip	2016/11/04 13:52	59,3 KB
R1-1611478.zip	2016/11/04 13:52	481,6 KB
R1-1611479.zip	2016/11/04 13:52	82,9 KB
R1-1611480.zip	2016/11/04 15:45	31,8 KB
R1-1611481.zip	2016/11/04 15:45	38,5 KB
R1-1611482.zip	2016/11/04 15:45	36,5 KB
R1-1611483.zip	2016/11/04 15:45	105 KB
R1-1611484.zip	2016/11/04 15:45	35,2 KB
R1-1611485.zip	2016/11/04 15:45	29,7 KB
R1-1611486.zip	2016/11/04 15:47	55,4 KB

Petitioners' Exhibit 1007, p. 1104
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1611487.zip	2016/11/04 15:47	47,7 KB
R1-1611488.zip	2016/11/04 15:47	53,1 KB
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R1-1611490.zip	2016/11/05 2:49	139,3 KB
R1-1611491.zip	2016/11/05 2:49	32,9 KB
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R1-1611493.zip	2016/11/04 15:45	58,7 KB
R1-1611494.zip	2016/11/04 15:45	33,4 KB
R1-1611495.zip	2016/11/04 15:45	47,8 KB
R1-1611496.zip	2016/11/04 15:45	43,9 KB
R1-1611497.zip	2016/11/04 15:47	59,9 KB
R1-1611499.zip	2016/11/06 3:12	69,8 KB
R1-1611500.zip	2016/11/06 3:12	254,6 KB
R1-1611501.zip	2016/11/06 3:12	61,7 KB
R1-1611502.zip	2016/11/04 13:45	107,5 KB
R1-1611503.zip	2016/11/04 13:45	24,6 KB
R1-1611504.zip	2016/11/04 13:45	129,7 KB
R1-1611505.zip	2016/11/04 13:45	21,2 KB
R1-1611506.zip	2016/11/04 13:45	21,9 KB
R1-1611507.zip	2016/11/04 13:45	27,3 KB
R1-1611508.zip	2016/11/04 13:45	98,6 KB
R1-1611509.zip	2016/11/04 17:35	40,5 KB
R1-1611510.zip	2016/11/04 13:55	27,5 KB
R1-1611511.zip	2016/11/04 13:55	22,7 KB
R1-1611512.zip	2016/11/04 13:55	399,4 KB
R1-1611513.zip	2016/11/04 13:55	42,5 KB
R1-1611514.zip	2016/11/04 13:55	27,5 KB
R1-1611515.zip	2016/11/04 13:55	94,6 KB
R1-1611516.zip	2016/11/04 13:55	32,7 KB
R1-1611517.zip	2016/11/04 18:15	186,9 KB
R1-1611518.zip	2016/11/04 18:15	417,7 KB
R1-1611519.zip	2016/11/04 13:59	301,6 KB
R1-1611520.zip	2016/11/04 13:59	361,9 KB
R1-1611521.zip	2016/11/04 13:59	23,7 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611523.zip	2016/11/04 13:59	38,9 KB
R1-1611524.zip	2016/11/04 13:59	30,2 KB
R1-1611525.zip	2016/11/04 17:35	40,4 KB
R1-1611526.zip	2016/11/04 14:03	65,5 KB
R1-1611527.zip	2016/11/04 14:03	18,8 KB
R1-1611528.zip	2016/11/04 14:03	58,7 KB
R1-1611529.zip	2016/11/04 14:03	30,2 KB
R1-1611530.zip	2016/11/04 14:03	24,4 KB
R1-1611531.zip	2016/11/04 14:03	9,6 KB
R1-1611532.zip	2016/11/04 14:03	20,6 KB
R1-1611533.zip	2016/11/04 18:15	112,6 KB
R1-1611534.zip	2016/11/04 23:30	28 KB
R1-1611535.zip	2016/11/04 23:30	130,8 KB
R1-1611536.zip	2016/11/04 23:30	81 KB
R1-1611537.zip	2016/11/04 23:30	36,4 KB
R1-1611538.zip	2016/11/04 23:30	100,5 KB
R1-1611539.zip	2016/11/04 23:30	126,6 KB
R1-1611540.zip	2016/11/04 23:30	73,5 KB
R1-1611541.zip	2016/11/04 23:30	72,8 KB
R1-1611542.zip	2016/11/04 23:30	55,8 KB
R1-1611543.zip	2016/11/04 23:31	273,4 KB
R1-1611544.zip	2016/11/04 23:31	667,4 KB
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R1-1611547.zip	2016/11/04 23:31	17,6 KB
R1-1611548.zip	2016/11/04 23:31	133,7 KB
R1-1611549.zip	2016/11/04 23:31	44,3 KB
R1-1611550.zip	2016/11/04 23:30	32,4 KB
R1-1611551.zip	2016/11/04 23:30	54,8 KB
R1-1611552.zip	2016/11/04 23:30	50,4 KB
R1-1611553.zip	2016/11/05 0:31	42,1 KB
R1-1611554.zip	2016/11/05 0:31	34,7 KB
R1-1611555.zip	2016/11/05 0:31	51 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611558.zip	2016/11/05 0:31	44,1 KB
R1-1611559.zip	2016/11/06 19:24	37,2 KB
R1-1611560.zip	2016/11/05 2:58	60,7 KB
R1-1611561.zip	2016/11/05 2:58	76,9 KB
R1-1611562.zip	2016/11/05 2:58	53,8 KB
R1-1611564.zip	2016/11/05 2:57	31,3 KB
R1-1611565.zip	2016/11/05 0:42	31,2 KB
R1-1611566.zip	2016/11/05 0:44	52,4 KB
R1-1611567.zip	2016/11/05 0:42	29,6 KB
R1-1611568.zip	2016/11/05 0:42	191,5 KB
R1-1611569.zip	2016/11/05 1:15	30 KB
R1-1611570.zip	2016/11/05 1:15	65 KB
R1-1611571.zip	2016/11/05 1:15	33,3 KB
R1-1611572.zip	2016/11/05 1:15	65,7 KB
R1-1611573.zip	2016/11/05 1:15	64,9 KB
R1-1611574.zip	2016/11/05 1:15	31,7 KB
R1-1611575.zip	2016/11/05 1:15	80,2 KB
R1-1611576.zip	2016/11/05 1:15	31,3 KB
R1-1611577.zip	2016/11/05 1:15	28,8 KB
R1-1611578.zip	2016/11/05 1:15	37,6 KB
R1-1611579.zip	2016/11/05 1:15	66,3 KB
R1-1611580.zip	2016/11/05 1:15	55,9 KB
R1-1611581.zip	2016/11/05 1:16	54,5 KB
R1-1611582.zip	2016/11/05 1:16	80,9 KB
R1-1611583.zip	2016/11/05 1:16	62,1 KB
R1-1611584.zip	2016/11/05 1:16	138,9 KB
R1-1611585.zip	2016/11/05 1:16	46,6 KB
R1-1611586.zip	2016/11/05 1:16	78,1 KB
R1-1611588.zip	2016/11/05 1:16	31,2 KB
R1-1611589.zip	2016/11/05 1:16	28,4 KB
R1-1611590.zip	2016/11/05 1:16	54,6 KB
R1-1611591.zip	2016/11/05 1:23	129,3 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611596.zip	2016/11/05 7:36	102,1 KB
R1-1611597.zip	2016/11/05 7:36	29,1 KB
R1-1611598.zip	2016/11/05 7:36	42,1 KB
R1-1611599.zip	2016/11/05 7:34	35,8 KB
R1-1611600.zip	2016/11/05 7:34	162,9 KB
R1-1611601.zip	2016/11/05 7:34	62,4 KB
R1-1611602.zip	2016/11/05 7:35	58 KB
R1-1611603.zip	2016/11/05 7:35	92,5 KB
R1-1611604.zip	2016/11/05 7:34	152,4 KB
R1-1611605.zip	2016/11/05 1:44	33,8 KB
R1-1611606.zip	2016/11/05 1:44	152,1 KB
R1-1611607.zip	2016/11/05 1:44	103 KB
R1-1611608.zip	2016/11/05 1:44	54,2 KB
R1-1611609.zip	2016/11/05 1:49	122,3 KB
R1-1611610.zip	2016/11/05 1:50	82,3 KB
R1-1611611.zip	2016/11/05 1:50	79,6 KB
R1-1611612.zip	2016/11/05 2:01	275,8 KB
R1-1611613.zip	2016/11/05 2:01	84 KB
R1-1611614.zip	2016/11/05 2:01	1382,2 KB
R1-1611615.zip	2016/11/05 2:02	429,2 KB
R1-1611616.zip	2016/11/05 2:02	37,7 KB
R1-1611617.zip	2016/11/05 2:02	315,9 KB
R1-1611618.zip	2016/11/05 2:01	28,7 KB
R1-1611619.zip	2016/11/05 2:55	98,4 KB
R1-1611620.zip	2016/11/05 2:33	77,4 KB
R1-1611621.zip	2016/11/05 2:33	127 KB
R1-1611622.zip	2016/11/05 2:33	78,8 KB
R1-1611623.zip	2016/11/05 2:33	386,5 KB
R1-1611625.zip	2016/11/05 2:33	120,7 KB
R1-1611626.zip	2016/11/05 2:33	195,4 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611628.zip	2016/11/05 2:33	149,5 KB
R1-1611629.zip	2016/11/05 2:33	131,6 KB
R1-1611630.zip	2016/11/05 2:33	130 KB
R1-1611631.zip	2016/11/05 2:33	130,4 KB
R1-1611632.zip	2016/11/05 2:33	302,7 KB
R1-1611633.zip	2016/11/05 2:33	160,3 KB
R1-1611634.zip	2016/11/05 2:33	79,8 KB
R1-1611635.zip	2016/11/05 2:52	88,7 KB
R1-1611636.zip	2016/11/05 2:52	56,6 KB
R1-1611637.zip	2016/11/05 2:52	235,6 KB
R1-1611638.zip	2016/11/05 2:52	301,4 KB
R1-1611639.zip	2016/11/05 2:52	489,6 KB
R1-1611640.zip	2016/11/05 2:52	192,8 KB
R1-1611641.zip	2016/11/05 2:52	305,6 KB
R1-1611642.zip	2016/11/05 2:52	484,9 KB
R1-1611643.zip	2016/11/05 2:52	484,8 KB
R1-1611644.zip	2016/11/05 2:52	586,1 KB
R1-1611645.zip	2016/11/05 2:52	501,5 KB
R1-1611646.zip	2016/11/05 2:52	190,6 KB
R1-1611647.zip	2016/11/05 2:55	62,2 KB
R1-1611648.zip	2016/11/05 3:02	45,1 KB
R1-1611649.zip	2016/11/05 4:40	94,4 KB
R1-1611650.zip	2016/11/05 4:40	93,2 KB
R1-1611651.zip	2016/11/05 4:40	34,1 KB
R1-1611652.zip	2016/11/05 4:40	37,5 KB
R1-1611653.zip	2016/11/05 4:40	179,5 KB
R1-1611654.zip	2016/11/05 4:41	111,3 KB
R1-1611655.zip	2016/11/05 4:41	148,9 KB
R1-1611656.zip	2016/11/14 14:17	50,9 KB
R1-1611657.zip	2016/11/05 8:56	385,8 KB
R1-1611658.zip	2016/11/05 8:56	90,6 KB
R1-1611659.zip	2016/11/06 2:05	132,5 KB
R1-1611660.zip	2016/11/05 4:40	37,1 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611664.zip	2016/11/05 4:41	191,5 KB
R1-1611665.zip	2016/11/05 4:41	72,6 KB
R1-1611666.zip	2016/11/05 4:41	661 KB
R1-1611667.zip	2016/11/05 4:40	407,1 KB
R1-1611668.zip	2016/11/05 4:40	150,7 KB
R1-1611669.zip	2016/11/05 4:41	152,7 KB
R1-1611670.zip	2016/11/05 4:40	471,9 KB
R1-1611671.zip	2016/11/05 4:40	91,4 KB
R1-1611672.zip	2016/11/05 4:40	163,9 KB
R1-1611673.zip	2016/11/05 4:40	95,4 KB
R1-1611674.zip	2016/11/05 4:40	119,4 KB
R1-1611675.zip	2016/11/05 4:40	228,1 KB
R1-1611676.zip	2016/11/05 4:40	276,6 KB
R1-1611677.zip	2016/11/05 4:40	43,5 KB
R1-1611678.zip	2016/11/05 4:41	166,5 KB
R1-1611679.zip	2016/11/05 4:40	65,5 KB
R1-1611680.zip	2016/11/05 4:40	34,2 KB
R1-1611681.zip	2016/11/05 4:41	158,9 KB
R1-1611682.zip	2016/11/05 4:41	219,3 KB
R1-1611683.zip	2016/11/05 4:40	34 KB
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R1-1611685.zip	2016/11/05 4:41	150,9 KB
R1-1611686.zip	2016/11/05 4:41	54,6 KB
R1-1611687.zip	2016/11/05 4:41	876,1 KB
R1-1611688.zip	2016/11/05 4:41	316,4 KB
R1-1611689.zip	2016/11/05 4:41	211,4 KB
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R1-1611692.zip	2016/11/05 5:24	767,3 KB
R1-1611693.zip	2016/11/05 4:40	139,6 KB
R1-1611694.zip	2016/11/05 4:41	106,1 KB
R1-1611695.zip	2016/11/05 4:41	57,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611697.zip	2016/11/04 9:21	44,5 KB
R1-1611698.zip	2016/11/04 9:21	111,9 KB
R1-1611699.zip	2016/11/04 9:21	227,8 KB
R1-1611700.zip	2016/11/04 9:40	44,7 KB
R1-1611701.zip	2016/11/04 9:21	17,9 KB
R1-1611702.zip	2016/11/04 9:21	55,1 KB
R1-1611703.zip	2016/11/04 9:22	836,4 KB
R1-1611704.zip	2016/11/04 9:22	24,7 KB
R1-1611705.zip	2016/11/04 9:22	24,9 KB
R1-1611706.zip	2016/11/04 9:22	38,3 KB
R1-1611707.zip	2016/11/04 9:22	176,5 KB
R1-1611708.zip	2016/11/05 13:49	202,7 KB
R1-1611709.zip	2016/11/05 13:49	578,5 KB
R1-1611710.zip	2016/11/06 5:11	747,2 KB
R1-1611711.zip	2016/11/06 5:11	78,1 KB
R1-1611712.zip	2016/11/04 3:25	594,1 KB
R1-1611713.zip	2016/11/04 3:25	238,4 KB
R1-1611714.zip	2016/11/04 3:25	603,9 KB
R1-1611715.zip	2016/11/04 3:26	568,3 KB
R1-1611716.zip	2016/11/04 3:26	46,6 KB
R1-1611717.zip	2016/11/04 3:26	74 KB
R1-1611718.zip	2016/11/04 3:26	101,5 KB
R1-1611719.zip	2016/11/04 3:26	180 KB
R1-1611720.zip	2016/11/04 3:26	100,4 KB
R1-1611721.zip	2016/11/04 3:26	151,5 KB
R1-1611722.zip	2016/11/04 3:26	66,6 KB
R1-1611723.zip	2016/11/04 3:26	54,4 KB
R1-1611724.zip	2016/11/04 3:26	41,1 KB
R1-1611725.zip	2016/11/04 3:26	31,2 KB
R1-1611726.zip	2016/11/04 3:26	62 KB
R1-1611727.zip	2016/11/04 3:26	36,2 KB
R1-1611728.zip	2016/11/04 0:30	152,6 KB
R1-1611729.zip	2016/11/05 1:53	34,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611732.zip	2016/11/05 1:53	37,9 KB
R1-1611733.zip	2016/11/06 4:32	48,6 KB
R1-1611734.zip	2016/11/05 5:48	41,9 KB
R1-1611735.zip	2016/11/05 5:49	63,7 KB
R1-1611736.zip	2016/11/05 5:49	55,5 KB
R1-1611737.zip	2016/11/05 5:49	38,4 KB
R1-1611738.zip	2016/11/05 5:49	40,4 KB
R1-1611739.zip	2016/11/06 4:32	93,7 KB
R1-1611740.zip	2016/11/05 5:49	62,3 KB
R1-1611741.zip	2016/11/05 5:49	43,9 KB
R1-1611743.zip	2016/11/05 5:49	40,9 KB
R1-1611744.zip	2016/11/05 5:49	37,8 KB
R1-1611745.zip	2016/11/06 4:32	64,9 KB
R1-1611746.zip	2016/11/05 5:49	86,3 KB
R1-1611747.zip	2016/11/06 4:32	69,5 KB
R1-1611748.zip	2016/11/05 1:53	76,8 KB
R1-1611749.zip	2016/11/05 1:53	32,7 KB
R1-1611750.zip	2016/11/05 1:53	60,4 KB
R1-1611751.zip	2016/11/05 1:53	43,7 KB
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R1-1611753.zip	2016/11/05 1:53	46,7 KB
R1-1611754.zip	2016/11/05 1:53	34,6 KB
R1-1611755.zip	2016/11/05 1:53	34,9 KB
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R1-1611757.zip	2016/11/05 1:53	37,9 KB
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R1-1611759.zip	2016/11/05 1:53	30,9 KB
R1-1611760.zip	2016/11/05 1:53	37,7 KB
R1-1611761.zip	2016/11/05 1:53	51,3 KB
R1-1611762.zip	2016/11/05 1:54	150,3 KB
R1-1611763.zip	2016/11/05 1:54	37,2 KB
R1-1611764.zip	2016/11/05 1:54	52,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611767.zip	2016/11/05 1:54	37,2 KB
R1-1611768.zip	2016/11/05 1:54	80,3 KB
R1-1611769.zip	2016/11/05 1:54	80 KB
R1-1611770.zip	2016/11/05 1:54	90,4 KB
R1-1611771.zip	2016/11/05 1:54	34,7 KB
R1-1611772.zip	2016/11/05 1:54	39,9 KB
R1-1611773.zip	2016/11/05 1:54	56,1 KB
R1-1611774.zip	2016/11/05 1:54	288,8 KB
R1-1611775.zip	2016/11/05 1:54	250,5 KB
R1-1611776.zip	2016/11/05 1:54	51,1 KB
R1-1611777.zip	2016/11/05 1:54	117,8 KB
R1-1611778.zip	2016/11/05 1:54	42,8 KB
R1-1611779.zip	2016/11/05 5:05	25,7 KB
R1-1611780.zip	2016/11/05 5:05	69,4 KB
R1-1611781.zip	2016/11/05 5:05	70,8 KB
R1-1611782.zip	2016/11/05 5:05	69,6 KB
R1-1611783.zip	2016/11/05 5:05	48 KB
R1-1611784.zip	2016/11/09 15:35	240,7 KB
R1-1611785.zip	2016/11/05 5:05	35,9 KB
R1-1611786.zip	2016/11/09 15:35	106,5 KB
R1-1611787.zip	2016/11/06 7:05	97,1 KB
R1-1611788.zip	2016/11/09 15:35	31,9 KB
R1-1611789.zip	2016/11/05 5:05	53,6 KB
R1-1611790.zip	2016/11/09 15:35	52,5 KB
R1-1611791.zip	2016/11/06 2:00	32,7 KB
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R1-1611793.zip	2016/11/06 7:05	264 KB
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R1-1611795.zip	2016/11/06 7:06	36,9 KB
R1-1611796.zip	2016/11/06 7:06	34,9 KB
R1-1611797.zip	2016/11/06 7:06	182,1 KB
R1-1611798.zip	2016/11/06 2:00	53,2 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611811.zip	2016/11/05 5:05	472 KB
R1-1611812.zip	2016/11/05 5:05	212,6 KB
R1-1611813.zip	2016/11/06 2:00	2076 KB
R1-1611814.zip	2016/11/05 5:05	403,1 KB
R1-1611815.zip	2016/11/05 5:05	89 KB
R1-1611816.zip	2016/11/05 5:05	37,1 KB
R1-1611817.zip	2016/11/05 5:05	41 KB
R1-1611818.zip	2016/11/05 5:05	175,6 KB
R1-1611819.zip	2016/11/05 5:05	40,7 KB
R1-1611820.zip	2016/11/05 5:05	125,8 KB
R1-1611821.zip	2016/11/05 5:05	174,6 KB
R1-1611822.zip	2016/11/05 5:05	44,3 KB
R1-1611823.zip	2016/11/05 5:05	52,5 KB
R1-1611824.zip	2016/11/05 5:05	35,7 KB
R1-1611825.zip	2016/11/05 5:06	35,6 KB
R1-1611826.zip	2016/11/05 5:06	61,8 KB
R1-1611827.zip	2016/11/05 5:06	116,6 KB
R1-1611828.zip	2016/11/12 9:36	82,2 KB
R1-1611829.zip	2016/11/05 5:06	42,8 KB
R1-1611830.zip	2016/11/19 22:25	30,4 KB
R1-1611831.zip	2016/11/05 5:06	38,9 KB
R1-1611832.zip	2016/11/05 5:06	38,4 KB

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IPR2024-01121

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R1-1611845.zip	2016/11/05 5:10	82,6 KB
R1-1611846.zip	2016/11/05 5:10	169,1 KB
R1-1611847.zip	2016/11/05 5:10	143,8 KB
R1-1611848.zip	2016/11/06 2:00	129,6 KB
R1-1611849.zip	2016/11/05 5:10	430,7 KB
R1-1611850.zip	2016/11/05 5:10	58 KB
R1-1611851.zip	2016/11/05 5:10	320 KB
R1-1611852.zip	2016/11/05 5:10	2413 KB
R1-1611853.zip	2016/11/05 5:10	74,2 KB
R1-1611854.zip	2016/11/05 5:11	332,9 KB
R1-1611855.zip	2016/11/05 5:11	46,5 KB
R1-1611856.zip	2016/11/11 10:29	232,7 KB
R1-1611857.zip	2016/11/05 5:11	38,8 KB
R1-1611858.zip	2016/11/05 5:11	34,8 KB
R1-1611859.zip	2016/11/05 5:11	85,3 KB
R1-1611860.zip	2016/11/05 5:11	83,8 KB
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R1-1611863.zip	2016/11/04 1:10	22,7 KB
R1-1611864.zip	2016/11/05 4:55	56,6 KB
R1-1611865.zip	2016/11/05 4:55	154,9 KB
R1-1611866.zip	2016/11/05 4:55	84,4 KB

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IPR2024-01121

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R1-1611871.zip	2016/11/05 3:26	228,8 KB
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R1-1611873.zip	2016/11/05 3:26	11,7 KB
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R1-1611877.zip	2016/11/05 3:26	85,4 KB
R1-1611878.zip	2016/11/05 3:26	149,1 KB
R1-1611879.zip	2016/11/05 3:26	336,1 KB
R1-1611880.zip	2016/11/05 3:26	27,8 KB
R1-1611881.zip	2016/11/05 3:30	148,2 KB
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R1-1611883.zip	2016/11/05 3:30	30,6 KB
R1-1611884.zip	2016/11/05 3:30	35,2 KB
R1-1611885.zip	2016/11/05 3:30	213,1 KB
R1-1611886.zip	2016/11/05 3:30	101,1 KB
R1-1611887.zip	2016/11/05 3:30	41 KB
R1-1611888.zip	2016/11/05 3:30	53,3 KB
R1-1611889.zip	2016/11/05 3:30	58,8 KB
R1-1611890.zip	2016/11/05 3:30	28,4 KB
R1-1611891.zip	2016/11/05 3:30	39,7 KB
R1-1611892.zip	2016/11/04 8:41	251,1 KB
R1-1611893.zip	2016/11/04 8:41	472,3 KB
R1-1611894.zip	2016/11/04 8:41	68,6 KB
R1-1611895.zip	2016/11/04 18:15	51,5 KB
R1-1611896.zip	2016/11/04 16:26	196,1 KB
R1-1611897.zip	2016/11/05 6:15	92,7 KB
R1-1611898.zip	2016/11/05 6:15	111,6 KB
R1-1611899.zip	2016/11/05 6:15	78,6 KB
R1-1611900.zip	2016/11/05 6:15	165,6 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611905.zip	2016/11/05 6:15	725,1 KB
R1-1611906.zip	2016/11/05 6:15	529,7 KB
R1-1611907.zip	2016/11/05 6:15	252,3 KB
R1-1611909.zip	2016/11/05 6:15	59,5 KB
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R1-1611912.zip	2016/11/05 6:15	58,1 KB
R1-1611913.zip	2016/11/05 6:15	51,5 KB
R1-1611914.zip	2016/11/05 6:15	153,4 KB
R1-1611915.zip	2016/11/05 6:15	222,9 KB
R1-1611916.zip	2016/11/05 6:15	143,7 KB
R1-1611917.zip	2016/11/06 5:06	26,4 KB
R1-1611918.zip	2016/11/06 5:06	28,2 KB
R1-1611919.zip	2016/11/06 5:06	66,7 KB
R1-1611920.zip	2016/11/06 5:06	56,4 KB
R1-1611921.zip	2016/11/06 5:06	78 KB
R1-1611922.zip	2016/11/06 5:06	58,9 KB
R1-1611923.zip	2016/11/06 5:06	513,7 KB
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R1-1611925.zip	2016/11/06 5:06	59,6 KB
R1-1611926.zip	2016/11/06 5:06	57,6 KB
R1-1611927.zip	2016/11/06 5:07	77,9 KB
R1-1611928.zip	2016/11/06 5:07	219,1 KB
R1-1611929.zip	2016/11/06 5:07	207 KB
R1-1611930.zip	2016/11/06 5:07	55,3 KB
R1-1611931.zip	2016/11/06 5:07	58,6 KB
R1-1611932.zip	2016/11/06 5:07	128,5 KB
R1-1611933.zip	2016/11/06 5:07	75,2 KB
R1-1611934.zip	2016/11/06 5:07	58,6 KB
R1-1611935.zip	2016/11/06 5:07	6734,4 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611939.zip	2016/11/06 5:08	58,6 KB
R1-1611940.zip	2016/11/06 5:08	55,5 KB
R1-1611941.zip	2016/11/06 5:08	59,1 KB
R1-1611942.zip	2016/11/06 5:08	54,3 KB
R1-1611943.zip	2016/11/06 5:08	89,3 KB
R1-1611944.zip	2016/11/06 5:08	111,6 KB
R1-1611945.zip	2016/11/06 5:08	61 KB
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R1-1611947.zip	2016/11/06 5:08	406,7 KB
R1-1611948.zip	2016/11/06 5:08	205,8 KB
R1-1611949.zip	2016/11/06 5:08	118,5 KB
R1-1611950.zip	2016/11/06 5:08	54,1 KB
R1-1611951.zip	2016/11/06 5:08	145,8 KB
R1-1611952.zip	2016/11/06 5:08	236,6 KB
R1-1611953.zip	2016/11/06 5:08	125,3 KB
R1-1611954.zip	2016/11/06 5:08	70,2 KB
R1-1611955.zip	2016/11/06 5:08	55,9 KB
R1-1611956.zip	2016/11/06 5:08	432,9 KB
R1-1611957.zip	2016/11/06 5:10	295,1 KB
R1-1611958.zip	2016/11/06 5:10	74,2 KB
R1-1611959.zip	2016/11/06 5:10	170,5 KB
R1-1611960.zip	2016/11/06 5:10	52,1 KB
R1-1611961.zip	2016/11/06 5:10	117 KB
R1-1611962.zip	2016/11/06 5:10	51,3 KB
R1-1611963.zip	2016/11/06 5:10	71,7 KB
R1-1611964.zip	2016/11/06 5:10	208,6 KB
R1-1611965.zip	2016/11/06 5:10	62,5 KB
R1-1611967.zip	2016/11/06 5:10	75,5 KB
R1-1611969.zip	2016/11/06 5:10	399,8 KB
R1-1611970.zip	2016/11/06 5:10	150,5 KB
R1-1611971.zip	2016/11/06 5:10	84,4 KB

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AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1611975.zip	2016/11/06 5:09	238,7 KB
R1-1611976.zip	2016/11/06 5:10	66,4 KB
R1-1611977.zip	2016/11/06 5:10	90,5 KB
R1-1611978.zip	2016/11/06 5:10	42,5 KB
R1-1611979.zip	2016/11/06 5:11	127,5 KB
R1-1611980.zip	2016/11/06 5:11	85,3 KB
R1-1611981.zip	2016/11/06 5:11	265,5 KB
R1-1611982.zip	2016/11/06 5:11	150,9 KB
R1-1611983.zip	2016/11/06 5:11	497,9 KB
R1-1611984.zip	2016/11/06 5:11	109,2 KB
R1-1611985.zip	2016/11/06 5:12	978,2 KB
R1-1611986.zip	2016/11/06 5:12	124,8 KB
R1-1611987.zip	2016/11/06 5:12	165,9 KB
R1-1611988.zip	2016/11/06 5:12	136,6 KB
R1-1611989.zip	2016/11/06 5:12	53,5 KB
R1-1611990.zip	2016/11/06 5:12	63,8 KB
R1-1611991.zip	2016/11/06 5:12	69,7 KB
R1-1611992.zip	2016/11/06 5:12	220,3 KB
R1-1611993.zip	2016/11/06 5:12	109,8 KB
R1-1611994.zip	2016/11/06 5:11	215 KB
R1-1611995.zip	2016/11/06 5:11	131,6 KB
R1-1611996.zip	2016/11/06 5:11	144,6 KB
R1-1611997.zip	2016/11/06 5:11	100,9 KB
R1-1611998.zip	2016/11/06 5:11	154,5 KB
R1-1611999.zip	2016/11/06 5:13	50,7 KB
R1-1612000.zip	2016/11/06 5:13	88,4 KB
R1-1612001.zip	2016/11/06 5:13	78,8 KB
R1-1612002.zip	2016/11/06 5:13	84,6 KB
R1-1612003.zip	2016/11/06 5:13	373,4 KB
R1-1612004.zip	2016/11/06 5:13	1246,8 KB
R1-1612005.zip	2016/11/06 5:13	569,6 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612012.zip	2016/11/06 5:13	26,3 KB
R1-1612013.zip	2016/11/05 3:11	49 KB
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R1-1612018.zip	2016/11/05 8:56	1167,3 KB
R1-1612019.zip	2016/11/06 3:46	1123,6 KB
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R1-1612022.zip	2016/11/05 10:23	140,5 KB
R1-1612023.zip	2016/11/06 3:37	324,8 KB
R1-1612024.zip	2016/11/05 9:26	322,4 KB
R1-1612025.zip	2016/11/05 9:26	269,8 KB
R1-1612026.zip	2016/11/05 9:26	190,7 KB
R1-1612027.zip	2016/11/05 3:55	213,9 KB
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R1-1612031.zip	2016/11/05 10:01	191,1 KB
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R1-1612042.zip	2016/11/05 3:55	233,8 KB

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IPR2024-01121

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R1-1612047.zip	2016/11/05 8:45	69,4 KB
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R1-1612049.zip	2016/11/05 8:45	92,7 KB
R1-1612050.zip	2016/11/05 10:37	137,7 KB
R1-1612051.zip	2016/11/06 3:20	1142,9 KB
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R1-1612057.zip	2016/11/05 8:45	81,2 KB
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R1-1612059.zip	2016/11/05 9:56	34,2 KB
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612087.zip	2016/11/06 2:34	446,3 KB
R1-1612088.zip	2016/11/06 2:38	193,1 KB
R1-1612089.zip	2016/11/06 2:38	88,4 KB
R1-1612091.zip	2016/11/06 2:47	83,6 KB
R1-1612093.zip	2016/11/05 3:55	55,8 KB
R1-1612094.zip	2016/11/05 3:55	43 KB
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R1-1612097.zip	2016/11/04 9:18	105 KB
R1-1612098.zip	2016/11/05 3:12	548,2 KB
R1-1612099.zip	2016/11/04 2:50	50 KB
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R1-1612103.zip	2016/11/04 17:54	51,4 KB
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R1-1612105.zip	2016/11/04 17:54	88,3 KB
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R1-1612112.zip	2016/11/04 7:24	74,8 KB
R1-1612113.zip	2016/11/04 7:24	152,7 KB
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R1-1612115.zip	2016/11/04 8:54	93,6 KB
R1-1612116.zip	2016/11/03 6:53	1225,7 KB

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IPR2024-01121

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R1-1612121.zip	2016/11/05 1:31	46,4 KB
R1-1612122.zip	2016/11/05 4:46	160,8 KB
R1-1612123.zip	2016/11/05 1:31	123,3 KB
R1-1612124.zip	2016/11/05 1:31	171,3 KB
R1-1612125.zip	2016/11/05 1:31	82,3 KB
R1-1612126.zip	2016/11/05 1:31	100 KB
R1-1612127.zip	2016/11/05 1:31	158,7 KB
R1-1612128.zip	2016/11/05 1:31	265,5 KB
R1-1612129.zip	2016/11/05 1:31	102,3 KB
R1-1612130.zip	2016/11/05 1:31	37,9 KB
R1-1612131.zip	2016/11/05 1:31	23,4 KB
R1-1612132.zip	2016/11/05 1:31	457,5 KB
R1-1612133.zip	2016/11/05 1:31	469,3 KB
R1-1612134.zip	2016/11/05 4:16	255,6 KB
R1-1612135.zip	2016/11/05 4:16	145,2 KB
R1-1612136.zip	2016/11/11 10:33	319 KB
R1-1612137.zip	2016/11/05 1:31	90,8 KB
R1-1612138.zip	2016/11/05 1:31	231,9 KB
R1-1612139.zip	2016/11/05 1:45	234,9 KB
R1-1612140.zip	2016/11/05 1:31	530,5 KB
R1-1612141.zip	2016/11/05 1:32	197,8 KB
R1-1612142.zip	2016/11/05 1:32	87,8 KB
R1-1612144.zip	2016/11/05 1:36	28,1 KB
R1-1612145.zip	2016/11/05 1:36	216,9 KB
R1-1612146.zip	2016/11/05 1:36	821,8 KB
R1-1612147.zip	2016/11/05 1:36	344,8 KB
R1-1612149.zip	2016/11/05 1:36	243,5 KB
R1-1612150.zip	2016/11/04 19:36	141,8 KB
R1-1612151.zip	2016/11/04 19:36	38,8 KB
R1-1612152.zip	2016/11/04 19:36	175,9 KB

Petitioners' Exhibit 1007, p. 1123
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1612153.zip	2016/11/04 19:36	62,2 KB
R1-1612154.zip	2016/11/04 19:36	256,7 KB
R1-1612155.zip	2016/11/04 17:55	69,5 KB
R1-1612156.zip	2016/11/04 17:55	522,2 KB
R1-1612157.zip	2016/11/04 17:55	363 KB
R1-1612158.zip	2016/11/04 17:55	89,2 KB
R1-1612159.zip	2016/11/04 17:55	55,2 KB
R1-1612160.zip	2016/11/04 17:55	106 KB
R1-1612161.zip	2016/11/06 5:13	252 KB
R1-1612162.zip	2016/11/06 5:14	68,6 KB
R1-1612163.zip	2016/11/06 5:14	37,3 KB
R1-1612164.zip	2016/11/06 5:14	66,9 KB
R1-1612165.zip	2016/11/06 5:14	98,2 KB
R1-1612166.zip	2016/11/06 5:13	65,1 KB
R1-1612167.zip	2016/11/06 5:13	89,3 KB
R1-1612168.zip	2016/11/04 17:55	284,8 KB
R1-1612169.zip	2016/11/04 17:55	627,5 KB
R1-1612170.zip	2016/11/04 17:56	590,5 KB
R1-1612171.zip	2016/11/05 2:08	118,6 KB
R1-1612172.zip	2016/11/05 2:08	48,9 KB
R1-1612173.zip	2016/11/05 2:08	113,1 KB
R1-1612174.zip	2016/11/05 2:08	56,2 KB
R1-1612175.zip	2016/11/05 2:08	193 KB
R1-1612176.zip	2016/11/05 2:08	54,3 KB
R1-1612177.zip	2016/11/05 2:08	350,8 KB
R1-1612178.zip	2016/11/05 2:08	109,9 KB
R1-1612179.zip	2016/11/05 2:08	235,4 KB
R1-1612180.zip	2016/11/05 2:09	169,3 KB
R1-1612181.zip	2016/11/05 2:09	218,3 KB
R1-1612182.zip	2016/11/05 2:09	871,4 KB
R1-1612183.zip	2016/11/05 2:09	412,8 KB
R1-1612184.zip	2016/11/05 2:09	46,6 KB
R1-1612185.zip	2016/11/05 2:09	123 KB
R1-1612186.zip	2016/11/05 2:09	648,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612187.zip	2016/11/05 2:09	423,8 KB
R1-1612188.zip	2016/11/05 2:09	41,7 KB
R1-1612189.zip	2016/11/05 2:09	65 KB
R1-1612190.zip	2016/11/05 2:09	38,5 KB
R1-1612191.zip	2016/11/05 2:09	214,1 KB
R1-1612192.zip	2016/11/05 2:09	268,4 KB
R1-1612193.zip	2016/11/04 6:48	73,2 KB
R1-1612194.zip	2016/11/04 6:48	166,2 KB
R1-1612195.zip	2016/11/04 6:48	120,7 KB
R1-1612196.zip	2016/11/04 6:48	102,5 KB
R1-1612197.zip	2016/11/04 6:48	145,6 KB
R1-1612198.zip	2016/11/04 6:48	50,3 KB
R1-1612199.zip	2016/11/04 6:48	341,5 KB
R1-1612200.zip	2016/11/04 6:48	226,5 KB
R1-1612201.zip	2016/11/04 6:48	227,6 KB
R1-1612202.zip	2016/11/04 6:48	1704,2 KB
R1-1612203.zip	2016/11/03 9:24	37,1 KB
R1-1612204.zip	2016/11/04 15:17	29 KB
R1-1612205.zip	2016/11/04 15:17	92 KB
R1-1612206.zip	2016/11/04 15:17	19,7 KB
R1-1612207.zip	2016/11/04 15:17	90,5 KB
R1-1612208.zip	2016/11/04 15:17	22,8 KB
R1-1612209.zip	2016/11/04 19:20	79,8 KB
R1-1612210.zip	2016/11/04 19:20	221,9 KB
R1-1612211.zip	2016/11/04 19:20	65,1 KB
R1-1612212.zip	2016/11/04 19:20	185,6 KB
R1-1612213.zip	2016/11/04 19:20	111,6 KB
R1-1612214.zip	2016/11/03 10:51	63,3 KB
R1-1612216.zip	2016/11/05 4:08	98,8 KB
R1-1612217.zip	2016/11/05 4:08	71,7 KB
R1-1612218.zip	2016/11/05 4:08	89,7 KB
R1-1612219.zip	2016/11/05 4:08	203,1 KB
R1-1612220.zip	2016/11/05 4:08	42,4 KB
R1-1612221.zip	2016/11/05 4:08	32,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612222.zip	2016/11/05 4:08	71,3 KB
R1-1612225.zip	2016/11/04 10:21	75,1 KB
R1-1612226.zip	2016/11/04 10:25	71,1 KB
R1-1612227.zip	2016/11/04 10:28	74,8 KB
R1-1612228.zip	2016/11/04 10:33	181,1 KB
R1-1612229.zip	2016/11/04 10:38	66,5 KB
R1-1612230.zip	2016/11/04 10:42	107,1 KB
R1-1612231.zip	2016/11/04 10:44	74,8 KB
R1-1612232.zip	2016/11/04 10:45	81,8 KB
R1-1612233.zip	2016/11/04 17:05	145,7 KB
R1-1612234.zip	2016/11/04 20:27	166,6 KB
R1-1612235.zip	2016/11/05 3:44	58,7 KB
R1-1612236.zip	2016/11/05 22:59	53,6 KB
R1-1612237.zip	2016/11/05 3:44	91,6 KB
R1-1612238.zip	2016/11/05 3:44	123 KB
R1-1612239.zip	2016/11/05 3:44	59,9 KB
R1-1612240.zip	2016/11/05 3:44	39,2 KB
R1-1612241.zip	2016/11/05 3:44	129,9 KB
R1-1612242.zip	2016/11/05 3:45	151,9 KB
R1-1612243.zip	2016/11/05 3:45	180,3 KB
R1-1612244.zip	2016/11/05 3:45	772,2 KB
R1-1612245.zip	2016/11/05 3:45	405,7 KB
R1-1612246.zip	2016/11/05 3:45	89,6 KB
R1-1612247.zip	2016/11/05 3:45	93,2 KB
R1-1612248.zip	2016/11/05 3:45	61,7 KB
R1-1612249.zip	2016/11/05 3:45	106,2 KB
R1-1612250.zip	2016/11/05 3:45	52,4 KB
R1-1612251.zip	2016/11/05 3:45	462,6 KB
R1-1612252.zip	2016/11/05 3:45	70,9 KB
R1-1612253.zip	2016/11/05 3:45	96,5 KB
R1-1612254.zip	2016/11/04 20:27	35,3 KB
R1-1612255.zip	2016/11/04 20:27	38,9 KB
R1-1612256.zip	2016/11/04 20:27	124,3 KB
R1-1612257.zip	2016/11/04 20:27	40,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612258.zip	2016/11/04 20:27	48,4 KB
R1-1612259.zip	2016/11/04 20:27	59,1 KB
R1-1612260.zip	2016/11/04 20:27	38,1 KB
R1-1612261.zip	2016/11/04 20:25	50,6 KB
R1-1612262.zip	2016/11/04 20:25	76,9 KB
R1-1612263.zip	2016/11/04 20:25	206,3 KB
R1-1612264.zip	2016/11/04 20:25	41,6 KB
R1-1612265.zip	2016/11/04 20:25	60,6 KB
R1-1612266.zip	2016/11/04 20:25	37,2 KB
R1-1612267.zip	2016/11/04 20:25	179,5 KB
R1-1612268.zip	2016/11/04 20:24	170,9 KB
R1-1612269.zip	2016/11/04 20:24	116,5 KB
R1-1612270.zip	2016/11/04 20:19	1608,3 KB
R1-1612271.zip	2016/11/04 22:38	223,7 KB
R1-1612272.zip	2016/11/04 22:38	58,2 KB
R1-1612273.zip	2016/11/04 22:38	109,9 KB
R1-1612274.zip	2016/11/04 18:15	154,5 KB
R1-1612275.zip	2016/11/04 20:21	82,3 KB
R1-1612276.zip	2016/11/04 20:21	224,3 KB
R1-1612277.zip	2016/11/04 20:21	408,4 KB
R1-1612278.zip	2016/11/04 20:21	52,4 KB
R1-1612279.zip	2016/11/04 20:19	98,1 KB
R1-1612280.zip	2016/11/04 20:19	271,9 KB
R1-1612281.zip	2016/11/04 20:19	313,5 KB
R1-1612282.zip	2016/11/04 20:19	90,9 KB
R1-1612283.zip	2016/11/04 20:20	1664,4 KB
R1-1612284.zip	2016/11/04 20:20	499,2 KB
R1-1612285.zip	2016/11/04 20:20	332,1 KB
R1-1612286.zip	2016/11/04 20:20	110,4 KB
R1-1612287.zip	2016/11/04 20:20	93,9 KB
R1-1612288.zip	2016/11/04 20:21	2459,2 KB
R1-1612289.zip	2016/11/05 0:39	170,9 KB
R1-1612290.zip	2016/11/04 23:33	24,6 KB
R1-1612291.zip	2016/11/04 23:34	24,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612292.zip	2016/11/04 23:34	50,3 KB
R1-1612293.zip	2016/11/04 23:34	30 KB
R1-1612294.zip	2016/11/04 23:34	23,6 KB
R1-1612295.zip	2016/11/04 23:34	24,2 KB
R1-1612296.zip	2016/11/04 20:13	882,4 KB
R1-1612297.zip	2016/11/04 20:13	64,1 KB
R1-1612298.zip	2016/11/04 20:13	99,3 KB
R1-1612299.zip	2016/11/04 20:13	52,6 KB
R1-1612300.zip	2016/11/04 20:13	241,6 KB
R1-1612301.zip	2016/11/10 17:48	63,8 KB
R1-1612302.zip	2016/11/10 17:48	496 KB
R1-1612303.zip	2016/11/10 17:48	76,4 KB
R1-1612304.zip	2016/11/04 15:28	33,4 KB
R1-1612305.zip	2016/11/04 10:52	104,1 KB
R1-1612306.zip	2016/11/04 22:15	389,3 KB
R1-1612307.zip	2016/11/04 10:52	30,8 KB
R1-1612308.zip	2016/11/04 22:15	1019,4 KB
R1-1612309.zip	2016/11/05 3:15	54,4 KB
R1-1612310.zip	2016/11/05 3:14	31,4 KB
R1-1612311.zip	2016/11/05 3:14	353,6 KB
R1-1612312.zip	2016/11/05 3:14	68,8 KB
R1-1612313.zip	2016/11/05 3:14	42,9 KB
R1-1612314.zip	2016/11/05 3:14	50,5 KB
R1-1612315.zip	2016/11/05 3:14	91 KB
R1-1612316.zip	2016/11/05 3:15	250 KB
R1-1612317.zip	2016/11/05 2:04	29,5 KB
R1-1612318.zip	2016/11/05 2:04	33,5 KB
R1-1612319.zip	2016/11/05 2:04	30,7 KB
R1-1612320.zip	2016/11/05 2:04	35,3 KB
R1-1612321.zip	2016/11/05 2:04	87,5 KB
R1-1612322.zip	2016/11/05 2:04	73 KB
R1-1612323.zip	2016/11/05 2:04	56,2 KB
R1-1612324.zip	2016/11/05 2:04	38,5 KB
R1-1612325.zip	2016/11/05 2:04	74,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612326.zip	2016/11/05 2:04	52 KB
R1-1612327.zip	2016/11/05 2:04	77,1 KB
R1-1612328.zip	2016/11/05 2:04	354,8 KB
R1-1612329.zip	2016/11/05 2:04	114,6 KB
R1-1612330.zip	2016/11/05 2:04	88,8 KB
R1-1612331.zip	2016/11/05 2:04	67,4 KB
R1-1612332.zip	2016/11/05 2:05	38,5 KB
R1-1612333.zip	2016/11/05 2:05	38,8 KB
R1-1612334.zip	2016/11/05 2:05	71,4 KB
R1-1612335.zip	2016/11/05 2:05	767,7 KB
R1-1612336.zip	2016/11/05 2:05	112 KB
R1-1612337.zip	2016/11/05 2:05	63,4 KB
R1-1612338.zip	2016/11/05 2:05	72,6 KB
R1-1612339.zip	2016/11/05 2:05	44,4 KB
R1-1612340.zip	2016/11/05 2:05	63,7 KB
R1-1612341.zip	2016/11/05 2:05	264,5 KB
R1-1612342.zip	2016/11/05 2:05	262,1 KB
R1-1612343.zip	2016/11/05 2:05	117,1 KB
R1-1612344.zip	2016/11/05 2:05	192,5 KB
R1-1612345.zip	2016/11/05 2:05	518,1 KB
R1-1612346.zip	2016/11/05 2:05	147,3 KB
R1-1612347.zip	2016/11/05 2:06	49,1 KB
R1-1612348.zip	2016/11/05 2:06	54,2 KB
R1-1612349.zip	2016/11/05 2:06	35 KB
R1-1612350.zip	2016/11/05 2:06	60,8 KB
R1-1612351.zip	2016/11/05 2:06	117,1 KB
R1-1612352.zip	2016/11/05 2:06	182,2 KB
R1-1612353.zip	2016/11/05 2:06	29,8 KB
R1-1612354.zip	2016/11/05 2:06	32,2 KB
R1-1612355.zip	2016/11/05 2:06	56,1 KB
R1-1612356.zip	2016/11/05 2:06	29,3 KB
R1-1612357.zip	2016/11/05 3:41	28,8 KB
R1-1612359.zip	2016/11/10 19:23	21,8 KB
R1-1612360.zip	2016/11/05 7:31	68,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612361.zip	2016/11/05 7:31	268,6 KB
R1-1612362.zip	2016/11/05 7:30	234,9 KB
R1-1612363.zip	2016/11/05 7:30	25,1 KB
R1-1612364.zip	2016/11/05 7:30	49,9 KB
R1-1612365.zip	2016/11/05 7:30	174,8 KB
R1-1612366.zip	2016/11/05 7:30	1525,1 KB
R1-1612367.zip	2016/11/05 7:30	392,3 KB
R1-1612368.zip	2016/11/05 12:47	89,7 KB
R1-1612369.zip	2016/11/05 7:30	31,8 KB
R1-1612370.zip	2016/11/05 7:30	322,8 KB
R1-1612371.zip	2016/11/05 7:30	28,7 KB
R1-1612372.zip	2016/11/05 7:30	81,8 KB
R1-1612373.zip	2016/11/05 7:30	278,2 KB
R1-1612374.zip	2016/11/04 19:36	50,1 KB
R1-1612375.zip	2016/11/04 17:35	58,6 KB
R1-1612376.zip	2016/11/04 17:35	56,8 KB
R1-1612377.zip	2016/11/04 19:00	35,6 KB
R1-1612378.zip	2016/11/04 20:16	506,3 KB
R1-1612379.zip	2016/11/05 2:52	200,2 KB
R1-1612380.zip	2016/11/05 2:21	41,1 KB
R1-1612381.zip	2016/11/04 15:55	168,9 KB
R1-1612382.zip	2016/11/04 15:55	422,3 KB
R1-1612383.zip	2016/11/04 15:55	60,3 KB
R1-1612384.zip	2016/11/04 8:01	53 KB
R1-1612385.zip	2016/11/04 19:50	12,8 KB
R1-1612386.zip	2016/11/04 19:52	50,7 KB
R1-1612387.zip	2016/11/04 15:55	52,5 KB
R1-1612388.zip	2016/11/04 15:55	200 KB
R1-1612389.zip	2016/11/04 15:55	51,7 KB
R1-1612390.zip	2016/11/04 15:55	95,2 KB
R1-1612391.zip	2016/11/04 15:55	228,8 KB
R1-1612392.zip	2016/11/04 15:55	145,9 KB
R1-1612393.zip	2016/11/04 15:55	279,2 KB
R1-1612394.zip	2016/11/04 15:55	96,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612395.zip	2016/11/04 15:55	274,4 KB
R1-1612396.zip	2016/11/04 15:55	153 KB
R1-1612397.zip	2016/11/04 7:58	48,3 KB
R1-1612398.zip	2016/11/04 7:58	48,3 KB
R1-1612399.zip	2016/11/04 7:58	97,3 KB
R1-1612400.zip	2016/11/04 7:58	110,8 KB
R1-1612401.zip	2016/11/04 7:58	195,7 KB
R1-1612402.zip	2016/11/04 7:58	52 KB
R1-1612403.zip	2016/11/04 7:58	100,9 KB
R1-1612404.zip	2016/11/04 7:59	48,7 KB
R1-1612405.zip	2016/11/04 7:59	93,9 KB
R1-1612406.zip	2016/11/04 7:59	67,4 KB
R1-1612407.zip	2016/11/04 7:59	343,5 KB
R1-1612408.zip	2016/11/04 7:59	147,4 KB
R1-1612409.zip	2016/11/04 7:59	48 KB
R1-1612410.zip	2016/11/04 7:59	87,3 KB
R1-1612411.zip	2016/11/04 7:59	70,1 KB
R1-1612412.zip	2016/11/04 7:59	124,2 KB
R1-1612413.zip	2016/11/04 19:50	55,6 KB
R1-1612414.zip	2016/11/04 21:25	282,6 KB
R1-1612415.zip	2016/11/04 21:36	180,6 KB
R1-1612416.zip	2016/11/04 21:36	119,1 KB
R1-1612417.zip	2016/11/04 21:36	143,5 KB
R1-1612418.zip	2016/11/04 7:01	54 KB
R1-1612419.zip	2016/11/04 21:36	1677,5 KB
R1-1612420.zip	2016/11/04 21:36	269,4 KB
R1-1612421.zip	2016/11/04 7:01	53,3 KB
R1-1612422.zip	2016/11/04 7:01	51,5 KB
R1-1612423.zip	2016/11/04 7:02	51,4 KB
R1-1612424.zip	2016/11/04 7:02	80,4 KB
R1-1612425.zip	2016/11/04 7:02	67,1 KB
R1-1612426.zip	2016/11/04 18:33	91,7 KB
R1-1612427.zip	2016/11/04 7:02	44,6 KB
R1-1612428.zip	2016/11/04 7:01	46 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612429.zip	2016/11/04 18:33	82,3 KB
R1-1612430.zip	2016/11/04 21:36	182,2 KB
R1-1612431.zip	2016/11/04 19:50	152,8 KB
R1-1612432.zip	2016/11/05 0:26	49,5 KB
R1-1612433.zip	2016/11/05 0:26	56,2 KB
R1-1612434.zip	2016/11/05 0:26	62,8 KB
R1-1612435.zip	2016/11/04 7:56	693,6 KB
R1-1612436.zip	2016/11/04 11:28	71,2 KB
R1-1612437.zip	2016/11/05 0:26	64,3 KB
R1-1612438.zip	2016/11/04 7:56	92 KB
R1-1612439.zip	2016/11/04 7:56	40,4 KB
R1-1612440.zip	2016/11/04 7:56	54,4 KB
R1-1612441.zip	2016/11/04 7:56	56,3 KB
R1-1612442.zip	2016/11/04 13:07	21 KB
R1-1612443.zip	2016/11/04 13:07	19,7 KB
R1-1612444.zip	2016/11/04 13:07	97,9 KB
R1-1612445.zip	2016/11/04 14:03	276,3 KB
R1-1612446.zip	2016/11/04 14:03	147,7 KB
R1-1612447.zip	2016/11/04 13:07	160,5 KB
R1-1612448.zip	2016/11/04 7:56	54,8 KB
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R1-1612451.zip	2016/11/04 23:13	211,4 KB
R1-1612452.zip	2016/11/04 18:51	52,5 KB
R1-1612453.zip	2016/11/04 7:56	52,4 KB
R1-1612454.zip	2016/11/04 7:56	52,9 KB
R1-1612455.zip	2016/11/04 7:57	119,7 KB
R1-1612456.zip	2016/11/04 9:10	154,1 KB
R1-1612457.zip	2016/11/04 7:57	46,4 KB
R1-1612458.zip	2016/11/04 8:16	141,3 KB
R1-1612459.zip	2016/11/04 9:30	481,1 KB
R1-1612460.zip	2016/11/04 9:30	942,5 KB
R1-1612461.zip	2016/11/04 9:30	902,9 KB
R1-1612462.zip	2016/11/04 10:25	235,1 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1612463.zip	2016/11/04 9:10	339,7 KB
R1-1612464.zip	2016/11/04 7:57	92,2 KB
R1-1612465.zip	2016/11/04 21:25	64 KB
R1-1612466.zip	2016/11/04 21:25	39,2 KB
R1-1612467.zip	2016/11/04 11:28	34,7 KB
R1-1612468.zip	2016/11/04 10:25	67,9 KB
R1-1612469.zip	2016/11/04 13:07	21,1 KB
R1-1612470.zip	2016/11/04 19:50	39,9 KB
R1-1612471.zip	2016/11/04 19:50	307,5 KB
R1-1612472.zip	2016/11/04 8:12	274,9 KB
R1-1612473.zip	2016/11/04 11:28	142,7 KB
R1-1612474.zip	2016/11/04 7:57	48 KB
R1-1612475.zip	2016/11/04 9:30	29,6 KB
R1-1612476.zip	2016/11/04 11:28	34,4 KB
R1-1612477.zip	2016/11/04 9:10	54 KB
R1-1612478.zip	2016/11/04 18:33	58,3 KB
R1-1612479.zip	2016/11/04 18:33	436,3 KB
R1-1612480.zip	2016/11/04 19:50	35,6 KB
R1-1612481.zip	2016/11/04 19:50	50,1 KB
R1-1612482.zip	2016/11/04 21:36	238,2 KB
R1-1612484.zip	2016/11/04 7:01	264,8 KB
R1-1612485.zip	2016/11/04 8:01	31,1 KB
R1-1612486.zip	2016/11/04 8:01	238,5 KB
R1-1612487.zip	2016/11/04 8:01	51,1 KB
R1-1612488.zip	2016/11/04 8:01	212,4 KB
R1-1612489.zip	2016/11/04 8:01	59,8 KB
R1-1612490.zip	2016/11/04 13:07	20,7 KB
R1-1612491.zip	2016/11/04 18:33	53 KB
R1-1612492.zip	2016/11/04 19:50	40,9 KB
R1-1612493.zip	2016/11/04 19:50	1748 KB
R1-1612494.zip	2016/11/04 7:01	206 KB
R1-1612495.zip	2016/11/04 21:25	47,6 KB
R1-1612496.zip	2016/11/04 21:25	144,3 KB
R1-1612497.zip	2016/11/04 7:01	30,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612498.zip	2016/11/04 7:01	463,1 KB
R1-1612499.zip	2016/11/04 9:30	78 KB
R1-1612500.zip	2016/11/04 18:33	119,4 KB
R1-1612501.zip	2016/11/04 18:33	47,7 KB
R1-1612502.zip	2016/11/04 21:36	139,4 KB
R1-1612503.zip	2016/11/04 21:36	478 KB
R1-1612504.zip	2016/11/04 21:36	361,1 KB
R1-1612505.zip	2016/11/04 7:01	104 KB
R1-1612506.zip	2016/11/04 7:01	221,6 KB
R1-1612507.zip	2016/11/04 7:01	222,9 KB
R1-1612508.zip	2016/11/04 7:01	340 KB
R1-1612509.zip	2016/11/04 9:10	54,5 KB
R1-1612510.zip	2016/11/04 8:52	53,1 KB
R1-1612511.zip	2016/11/04 8:44	114,7 KB
R1-1612512.zip	2016/11/04 8:12	81,3 KB
R1-1612513.zip	2016/11/04 8:12	136,5 KB
R1-1612514.zip	2016/11/04 8:12	49,7 KB
R1-1612515.zip	2016/11/04 21:25	179,8 KB
R1-1612516.zip	2016/11/04 21:25	231,2 KB
R1-1612517.zip	2016/11/04 21:25	363 KB
R1-1612518.zip	2016/11/04 13:07	266,9 KB
R1-1612519.zip	2016/11/04 7:01	60 KB
R1-1612520.zip	2016/11/04 8:36	91,3 KB
R1-1612521.zip	2016/11/11 10:29	45,9 KB
R1-1612522.zip	2016/11/04 8:36	71,8 KB
R1-1612523.zip	2016/11/11 10:29	43,7 KB
R1-1612524.zip	2016/11/05 0:26	55,3 KB
R1-1612525.zip	2016/11/05 0:26	48 KB
R1-1612526.zip	2016/11/05 0:26	85,7 KB
R1-1612527.zip	2016/11/05 0:26	53,6 KB
R1-1612528.zip	2016/11/04 8:16	171,1 KB
R1-1612529.zip	2016/11/04 7:57	125,7 KB
R1-1612530.zip	2016/11/04 13:07	405,6 KB
R1-1612531.zip	2016/11/04 7:57	93,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612532.zip	2016/11/14 14:17	253,7 KB
R1-1612533.zip	2016/11/04 13:08	452,4 KB
R1-1612534.zip	2016/11/04 7:57	98,4 KB
R1-1612535.zip	2016/11/04 7:59	157,2 KB
R1-1612536.zip	2016/11/04 8:22	110 KB
R1-1612537.zip	2016/11/04 8:22	111,4 KB
R1-1612538.zip	2016/11/04 8:22	81,4 KB
R1-1612539.zip	2016/11/04 8:22	139,9 KB
R1-1612540.zip	2016/11/04 8:36	69 KB
R1-1612541.zip	2016/11/04 8:36	20 KB
R1-1612542.zip	2016/11/04 8:36	28,3 KB
R1-1612543.zip	2016/11/04 8:36	43,7 KB
R1-1612544.zip	2016/11/04 8:16	20,7 KB
R1-1612545.zip	2016/11/05 0:26	49,4 KB
R1-1612546.zip	2016/11/05 0:26	49,8 KB
R1-1612547.zip	2016/11/05 8:28	969,4 KB
R1-1612548.zip	2016/11/05 8:28	57,7 KB
R1-1612549.zip	2016/11/05 8:28	889 KB
R1-1612550.zip	2016/11/05 8:28	1245,5 KB
R1-1612551.zip	2016/11/05 8:28	305,6 KB
R1-1612552.zip	2016/11/05 8:28	81,4 KB
R1-1612553.zip	2016/11/05 8:29	599,8 KB
R1-1612554.zip	2016/11/05 8:29	842,2 KB
R1-1612555.zip	2016/11/05 8:29	1102,9 KB
R1-1612556.zip	2016/11/04 8:01	117,9 KB
R1-1612557.zip	2016/11/04 8:01	330,7 KB
R1-1612558.zip	2016/11/04 8:01	58,1 KB
R1-1612559.zip	2016/11/04 14:03	264,4 KB
R1-1612560.zip	2016/11/04 22:30	86,8 KB
R1-1612561.zip	2016/11/19 22:25	74,7 KB
R1-1612562.zip	2016/11/04 22:30	100,7 KB
R1-1612563.zip	2016/11/04 22:30	114 KB
R1-1612564.zip	2016/11/04 22:30	68,1 KB
R1-1612565.zip	2016/11/05 0:26	48,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612566.zip	2016/11/04 9:41	121,9 KB
R1-1612567.zip	2016/11/04 9:41	386,3 KB
R1-1612568.zip	2016/11/04 7:57	79,5 KB
R1-1612569.zip	2016/11/04 10:25	93,1 KB
R1-1612570.zip	2016/11/04 10:25	48,8 KB
R1-1612571.zip	2016/11/04 10:25	76,8 KB
R1-1612572.zip	2016/11/04 10:25	55,5 KB
R1-1612573.zip	2016/11/04 10:25	138,7 KB
R1-1612574.zip	2016/11/04 10:25	290,5 KB
R1-1612575.zip	2016/11/04 10:25	39,3 KB
R1-1612576.zip	2016/11/04 10:25	44,9 KB
R1-1612577.zip	2016/11/06 5:13	53,6 KB
R1-1612578.zip	2016/11/06 5:14	55,8 KB
R1-1612579.zip	2016/11/06 5:14	54,9 KB
R1-1612580.zip	2016/11/06 5:14	64,7 KB
R1-1612581.zip	2016/11/06 5:14	588,3 KB
R1-1612582.zip	2016/11/06 5:15	58,7 KB
R1-1612583.zip	2016/11/06 5:15	102,1 KB
R1-1612584.zip	2016/11/06 5:14	117,6 KB
R1-1612585.zip	2016/11/06 5:14	107,2 KB
R1-1612586.zip	2016/11/06 5:14	177,2 KB
R1-1612587.zip	2016/11/06 5:14	89,9 KB
R1-1612588.zip	2016/11/06 5:14	1286,6 KB
R1-1612589.zip	2016/11/06 5:14	445,1 KB
R1-1612590.zip	2016/11/06 5:14	18,6 KB
R1-1612591.zip	2016/11/05 1:54	72,6 KB
R1-1612592.zip	2016/11/06 5:14	45,4 KB
R1-1612593.zip	2016/11/04 21:48	350,5 KB
R1-1612594.zip	2016/11/04 21:48	59,3 KB
R1-1612595.zip	2016/11/04 21:48	108,1 KB
R1-1612596.zip	2016/11/04 21:48	59,9 KB
R1-1612597.zip	2016/11/04 21:48	61,4 KB
R1-1612598.zip	2016/11/04 21:48	92 KB
R1-1612599.zip	2016/11/04 21:48	81,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612600.zip	2016/11/04 21:48	521,4 KB
R1-1612601.zip	2016/11/05 3:35	90,6 KB
R1-1612602.zip	2016/11/05 3:35	501,4 KB
R1-1612603.zip	2016/11/05 3:35	296,5 KB
R1-1612604.zip	2016/11/05 3:35	140,4 KB
R1-1612605.zip	2016/11/05 3:35	54,3 KB
R1-1612606.zip	2016/11/05 3:35	83,9 KB
R1-1612607.zip	2016/11/04 20:11	506,7 KB
R1-1612608.zip	2016/11/04 12:07	113 KB
R1-1612609.zip	2016/11/04 20:36	140,2 KB
R1-1612610.zip	2016/11/04 20:36	568,8 KB
R1-1612611.zip	2016/11/04 22:08	31,3 KB
R1-1612612.zip	2016/11/04 22:08	25,1 KB
R1-1612613.zip	2016/11/04 22:08	60 KB
R1-1612614.zip	2016/11/04 22:08	274,3 KB
R1-1612615.zip	2016/11/04 22:08	65,6 KB
R1-1612616.zip	2016/11/04 22:08	66,3 KB
R1-1612617.zip	2016/11/04 22:08	123,3 KB
R1-1612618.zip	2016/11/04 22:08	180,9 KB
R1-1612619.zip	2016/11/04 22:09	176,7 KB
R1-1612620.zip	2016/11/04 22:09	59 KB
R1-1612621.zip	2016/11/04 22:09	77,4 KB
R1-1612622.zip	2016/11/04 22:09	53,3 KB
R1-1612623.zip	2016/11/04 22:09	70,3 KB
R1-1612624.zip	2016/11/04 20:36	189 KB
R1-1612625.zip	2016/11/04 11:02	54,5 KB
R1-1612626.zip	2016/11/05 16:36	26,8 KB
R1-1612627.zip	2016/11/05 4:56	266,7 KB
R1-1612628.zip	2016/11/05 4:57	90,1 KB
R1-1612629.zip	2016/11/05 0:07	396,2 KB
R1-1612630.zip	2016/11/05 4:58	417,2 KB
R1-1612631.zip	2016/11/05 4:58	310 KB
R1-1612632.zip	2016/11/05 1:53	339,3 KB
R1-1612633.zip	2016/11/05 2:38	179,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612634.zip	2016/11/05 2:39	251,1 KB
R1-1612635.zip	2016/11/05 2:40	352,4 KB
R1-1612636.zip	2016/11/05 4:59	27,9 KB
R1-1612637.zip	2016/11/05 2:40	128,4 KB
R1-1612638.zip	2016/11/05 2:41	82 KB
R1-1612639.zip	2016/11/05 2:41	380,2 KB
R1-1612640.zip	2016/11/05 2:42	298,8 KB
R1-1612641.zip	2016/11/05 2:42	219,7 KB
R1-1612642.zip	2016/11/05 5:00	27 KB
R1-1612644.zip	2016/11/05 2:43	176,6 KB
R1-1612645.zip	2016/11/05 2:43	138,5 KB
R1-1612646.zip	2016/11/05 2:43	494,1 KB
R1-1612647.zip	2016/11/05 2:44	750,7 KB
R1-1612648.zip	2016/11/05 2:44	111,1 KB
R1-1612649.zip	2016/11/05 3:05	46 KB
R1-1612650.zip	2016/11/04 9:14	44,6 KB
R1-1612651.zip	2016/11/04 9:14	556,6 KB
R1-1612652.zip	2016/11/14 14:17	4243,9 KB
R1-1612653.zip	2016/11/05 2:45	45,9 KB
R1-1612654.zip	2016/11/05 2:46	70,6 KB
R1-1612655.zip	2016/11/05 2:46	858,1 KB
R1-1612656.zip	2016/11/05 2:46	226,7 KB
R1-1612657.zip	2016/11/05 2:47	189,9 KB
R1-1612658.zip	2016/11/05 2:47	260,1 KB
R1-1612659.zip	2016/11/05 2:47	181,1 KB
R1-1612660.zip	2016/11/05 1:45	60,5 KB
R1-1612661.zip	2016/11/04 23:51	132,8 KB
R1-1612662.zip	2016/11/05 1:46	45,6 KB
R1-1612663.zip	2016/11/05 1:45	142,1 KB
R1-1612664.zip	2016/11/05 1:45	50 KB
R1-1612665.zip	2016/11/05 1:45	228,8 KB
R1-1612666.zip	2016/11/05 3:01	53,2 KB
R1-1612667.zip	2016/11/05 3:39	60,6 KB
R1-1612668.zip	2016/11/05 3:09	99,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612670.zip	2016/11/05 2:35	310,5 KB
R1-1612671.zip	2016/11/05 2:35	103,7 KB
R1-1612672.zip	2016/11/05 2:35	214,9 KB
R1-1612673.zip	2016/11/05 2:35	119,3 KB
R1-1612674.zip	2016/11/05 2:53	59,3 KB
R1-1612675.zip	2016/11/05 3:15	59,6 KB
R1-1612676.zip	2016/11/05 2:36	61,4 KB
R1-1612677.zip	2016/11/05 2:36	184,1 KB
R1-1612678.zip	2016/11/05 2:55	175,9 KB
R1-1612679.zip	2016/11/05 2:57	49,8 KB
R1-1612680.zip	2016/11/05 3:31	118,8 KB
R1-1612681.zip	2016/11/05 3:13	73,7 KB
R1-1612682.zip	2016/11/05 2:54	75 KB
R1-1612683.zip	2016/11/05 2:46	220,4 KB
R1-1612684.zip	2016/11/05 2:47	122,1 KB
R1-1612685.zip	2016/11/05 5:01	57,4 KB
R1-1612686.zip	2016/11/04 10:53	30,3 KB
R1-1612687.zip	2016/11/04 10:53	203,6 KB
R1-1612688.zip	2016/11/04 10:52	32,7 KB
R1-1612689.zip	2016/11/04 10:53	107,6 KB
R1-1612690.zip	2016/11/05 5:35	64,4 KB
R1-1612691.zip	2016/11/05 5:35	91,8 KB
R1-1612692.zip	2016/11/05 5:35	124,3 KB
R1-1612693.zip	2016/11/05 5:35	142,1 KB
R1-1612694.zip	2016/11/05 5:35	110,8 KB
R1-1612695.zip	2016/11/05 5:35	508,4 KB
R1-1612696.zip	2016/11/05 5:34	215 KB
R1-1612697.zip	2016/11/05 5:34	132,6 KB
R1-1612698.zip	2016/11/05 5:34	357,9 KB
R1-1612699.zip	2016/11/05 5:34	231,4 KB
R1-1612700.zip	2016/11/04 10:24	74 KB
R1-1612701.zip	2016/11/05 6:25	315,8 KB
R1-1612702.zip	2016/11/05 6:25	247,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612705.zip	2016/11/04 10:24	418,6 KB
R1-1612706.zip	2016/11/04 10:24	653,5 KB
R1-1612707.zip	2016/11/04 10:24	481,8 KB
R1-1612708.zip	2016/11/04 10:24	734 KB
R1-1612709.zip	2016/11/04 10:24	293,9 KB
R1-1612710.zip	2016/11/04 10:24	125,1 KB
R1-1612711.zip	2016/11/04 10:24	97,9 KB
R1-1612712.zip	2016/11/04 10:24	1202,6 KB
R1-1612713.zip	2016/11/04 10:53	80,8 KB
R1-1612714.zip	2016/11/05 5:40	381,9 KB
R1-1612715.zip	2016/11/05 5:34	61,5 KB
R1-1612716.zip	2016/11/05 5:34	63,4 KB
R1-1612717.zip	2016/11/05 5:34	54,5 KB
R1-1612718.zip	2016/11/05 5:35	131,8 KB
R1-1612719.zip	2016/11/05 5:35	97,7 KB
R1-1612720.zip	2016/11/05 5:35	105,5 KB
R1-1612721.zip	2016/11/05 2:52	143,2 KB
R1-1612722.zip	2016/11/05 2:52	73,2 KB
R1-1612723.zip	2016/11/05 2:52	34,7 KB
R1-1612724.zip	2016/11/05 2:52	864,5 KB
R1-1612725.zip	2016/11/05 6:25	67,4 KB
R1-1612726.zip	2016/11/05 6:25	93,1 KB
R1-1612727.zip	2016/11/05 6:25	153,3 KB
R1-1612728.zip	2016/11/05 6:25	691,3 KB
R1-1612729.zip	2016/11/05 6:25	179,3 KB
R1-1612730.zip	2016/11/05 6:25	177,5 KB
R1-1612731.zip	2016/11/05 6:25	193,5 KB
R1-1612732.zip	2016/11/05 2:52	87,3 KB
R1-1612733.zip	2016/11/05 2:52	178,4 KB
R1-1612734.zip	2016/11/05 6:25	114,4 KB
R1-1612735.zip	2016/11/05 6:25	129 KB
R1-1612736.zip	2016/11/05 5:35	238,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612738.zip	2016/11/05 8:45	599,9 KB
R1-1612739.zip	2016/11/06 4:41	32,3 KB
R1-1612740.zip	2016/11/06 4:41	41,1 KB
R1-1612741.zip	2016/11/06 4:41	54,7 KB
R1-1612743.zip	2016/11/06 4:41	22,5 KB
R1-1612744.zip	2016/11/06 4:41	37 KB
R1-1612745.zip	2016/11/13 2:20	228,7 KB
R1-1612746.zip	2016/11/06 5:56	30,4 KB
R1-1612747.zip	2016/11/06 6:12	30,6 KB
R1-1612748.zip	2016/11/04 23:59	864,2 KB
R1-1612749.zip	2016/11/04 23:59	370,8 KB
R1-1612750.zip	2016/11/05 7:46	71,9 KB
R1-1612751.zip	2016/11/04 11:58	30,9 KB
R1-1612752.zip	2016/11/04 11:58	42 KB
R1-1612753.zip	2016/11/04 11:58	101,8 KB
R1-1612754.zip	2016/11/04 11:58	19,8 KB
R1-1612755.zip	2016/11/04 8:10	143,5 KB
R1-1612756.zip	2016/11/04 8:00	164,8 KB
R1-1612757.zip	2016/11/04 8:00	34,8 KB
R1-1612758.zip	2016/11/05 1:42	31 KB
R1-1612759.zip	2016/11/04 8:00	32,7 KB
R1-1612760.zip	2016/11/05 3:02	21,8 KB
R1-1612761.zip	2016/11/05 3:02	33,2 KB
R1-1612762.zip	2016/11/05 3:02	31,2 KB
R1-1612763.zip	2016/11/04 20:35	46,2 KB
R1-1612764.zip	2016/11/11 10:29	73,5 KB
R1-1612765.zip	2016/11/04 8:20	201,3 KB
R1-1612766.zip	2016/11/04 8:12	22,6 KB
R1-1612767.zip	2016/11/04 8:12	25 KB
R1-1612768.zip	2016/11/04 9:55	22,2 KB
R1-1612769.zip	2016/11/05 4:49	85,7 KB
R1-1612770.zip	2016/11/05 4:49	89,4 KB
R1-1612771.zip	2016/11/05 4:49	110,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612773.zip	2016/11/05 4:49	28,8 KB
R1-1612774.zip	2016/11/05 4:49	19,4 KB
R1-1612775.zip	2016/11/05 4:49	62,9 KB
R1-1612776.zip	2016/11/05 4:49	157,8 KB
R1-1612777.zip	2016/11/05 4:49	58,4 KB
R1-1612778.zip	2016/11/05 4:49	59,1 KB
R1-1612779.zip	2016/11/05 4:49	58,3 KB
R1-1612780.zip	2016/11/05 4:49	59,4 KB
R1-1612781.zip	2016/11/05 4:49	59,7 KB
R1-1612782.zip	2016/11/04 9:35	59,7 KB
R1-1612783.zip	2016/11/04 9:35	114 KB
R1-1612784.zip	2016/11/04 9:35	15,9 KB
R1-1612785.zip	2016/11/04 9:35	38,9 KB
R1-1612786.zip	2016/11/04 19:36	25,1 KB
R1-1612787.zip	2016/11/04 19:00	72,4 KB
R1-1612788.zip	2016/11/04 19:00	73,4 KB
R1-1612789.zip	2016/11/04 19:00	70,2 KB
R1-1612790.zip	2016/11/04 19:00	170,2 KB
R1-1612791.zip	2016/11/04 19:19	38,8 KB
R1-1612792.zip	2016/11/04 19:19	64,7 KB
R1-1612793.zip	2016/11/04 20:19	176,2 KB
R1-1612794.zip	2016/11/04 10:50	32,4 KB
R1-1612795.zip	2016/11/05 9:52	45,1 KB
R1-1612796.zip	2016/11/05 9:02	62,8 KB
R1-1612797.zip	2016/11/05 9:02	100,5 KB
R1-1612798.zip	2016/11/04 14:32	337,9 KB
R1-1612799.zip	2016/11/04 20:25	37 KB
R1-1612800.zip	2016/11/04 20:26	41,7 KB
R1-1612801.zip	2016/11/04 20:25	148,2 KB
R1-1612802.zip	2016/11/04 20:25	32,6 KB
R1-1612803.zip	2016/11/04 20:25	91,3 KB
R1-1612804.zip	2016/11/04 20:25	242 KB
R1-1612805.zip	2016/11/04 20:25	128,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612806.zip	2016/11/04 20:25	71,2 KB
R1-1612807.zip	2016/11/04 20:25	165 KB
R1-1612808.zip	2016/11/04 20:25	49,4 KB
R1-1612809.zip	2016/11/04 20:25	271,6 KB
R1-1612810.zip	2016/11/04 20:25	203,8 KB
R1-1612811.zip	2016/11/04 20:25	69,1 KB
R1-1612812.zip	2016/11/04 9:47	26,7 KB
R1-1612813.zip	2016/11/04 9:47	28 KB
R1-1612814.zip	2016/11/04 9:47	35,6 KB
R1-1612815.zip	2016/11/05 3:30	112,7 KB
R1-1612816.zip	2016/11/05 3:30	37 KB
R1-1612817.zip	2016/11/05 3:30	40,2 KB
R1-1612818.zip	2016/11/05 3:30	164,5 KB
R1-1612819.zip	2016/11/05 3:30	26,1 KB
R1-1612820.zip	2016/11/05 3:30	36,5 KB
R1-1612821.zip	2016/11/05 3:30	45,8 KB
R1-1612822.zip	2016/11/05 3:30	16,4 KB
R1-1612823.zip	2016/11/05 3:30	79,6 KB
R1-1612824.zip	2016/11/05 3:30	32 KB
R1-1612825.zip	2016/11/05 3:30	45,8 KB
R1-1612826.zip	2016/11/05 3:30	304,4 KB
R1-1612827.zip	2016/11/05 3:30	148,1 KB
R1-1612828.zip	2016/11/05 3:30	213,5 KB
R1-1612829.zip	2016/11/05 3:30	27,6 KB
R1-1612830.zip	2016/11/05 3:30	27,9 KB
R1-1612831.zip	2016/11/05 3:30	55,7 KB
R1-1612832.zip	2016/11/05 3:30	55,8 KB
R1-1612833.zip	2016/11/05 3:30	52,7 KB
R1-1612834.zip	2016/11/04 13:11	71,6 KB
R1-1612835.zip	2016/11/05 5:02	95,4 KB
R1-1612836.zip	2016/11/05 4:15	38,1 KB
R1-1612837.zip	2016/11/05 4:16	250,6 KB
R1-1612838.zip	2016/11/05 4:16	304,8 KB
R1-1612839.zip	2016/11/05 4:16	52,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612840.zip	2016/11/04 20:21	217,1 KB
R1-1612841.zip	2016/11/04 20:21	151,7 KB
R1-1612842.zip	2016/11/04 20:21	169,3 KB
R1-1612843.zip	2016/11/04 20:21	182,9 KB
R1-1612844.zip	2016/11/04 20:21	47,6 KB
R1-1612845.zip	2016/11/04 20:21	52,6 KB
R1-1612846.zip	2016/11/04 20:21	39,7 KB
R1-1612847.zip	2016/11/04 20:21	402,4 KB
R1-1612849.zip	2016/11/04 20:21	212,9 KB
R1-1612850.zip	2016/11/04 20:21	400,1 KB
R1-1612851.zip	2016/11/04 20:21	193,5 KB
R1-1612852.zip	2016/11/04 20:21	155,1 KB
R1-1612853.zip	2016/11/04 20:21	34,4 KB
R1-1612854.zip	2016/11/04 20:21	38,2 KB
R1-1612855.zip	2016/11/04 20:21	35,3 KB
R1-1612856.zip	2016/11/04 20:21	44,8 KB
R1-1612857.zip	2016/11/04 20:22	756,1 KB
R1-1612858.zip	2016/11/04 20:22	78,2 KB
R1-1612859.zip	2016/11/04 20:22	39,6 KB
R1-1612860.zip	2016/11/04 20:22	338,6 KB
R1-1612861.zip	2016/11/04 20:22	123,1 KB
R1-1612862.zip	2016/11/04 20:20	410,9 KB
R1-1612863.zip	2016/11/04 20:20	184 KB
R1-1612864.zip	2016/11/04 20:20	40,6 KB
R1-1612865.zip	2016/11/04 20:20	45,2 KB
R1-1612866.zip	2016/11/04 20:20	102,4 KB
R1-1612867.zip	2016/11/04 20:20	224,9 KB
R1-1612868.zip	2016/11/04 20:20	374,3 KB
R1-1612869.zip	2016/11/04 20:20	35,1 KB
R1-1612870.zip	2016/11/04 20:20	33,7 KB
R1-1612871.zip	2016/11/04 20:20	37,1 KB
R1-1612872.zip	2016/11/04 20:20	40,8 KB
R1-1612873.zip	2016/11/04 20:20	36,3 KB
R1-1612874.zip	2016/11/04 20:20	387 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612875.zip	2016/11/04 20:20	33,4 KB
R1-1612876.zip	2016/11/04 20:20	110,3 KB
R1-1612877.zip	2016/11/05 4:16	596,9 KB
R1-1612878.zip	2016/11/04 10:46	205,7 KB
R1-1612879.zip	2016/11/06 1:37	56,4 KB
R1-1612880.zip	2016/11/05 3:01	50,5 KB
R1-1612881.zip	2016/11/05 3:01	79,1 KB
R1-1612882.zip	2016/11/05 3:01	82,4 KB
R1-1612883.zip	2016/11/06 1:38	55,3 KB
R1-1612884.zip	2016/11/06 1:38	52,7 KB
R1-1612885.zip	2016/11/05 3:01	24,3 KB
R1-1612886.zip	2016/11/06 1:38	52,5 KB
R1-1612887.zip	2016/11/04 15:35	29,5 KB
R1-1612888.zip	2016/11/05 4:47	46,4 KB
R1-1612889.zip	2016/11/04 23:30	37,2 KB
R1-1612890.zip	2016/11/04 23:30	183,4 KB
R1-1612891.zip	2016/11/04 23:30	139,7 KB
R1-1612892.zip	2016/11/04 23:30	26,1 KB
R1-1612893.zip	2016/11/04 23:30	67,1 KB
R1-1612894.zip	2016/11/04 21:14	40,8 KB
R1-1612895.zip	2016/11/04 21:14	24,1 KB
R1-1612896.zip	2016/11/04 21:14	72,5 KB
R1-1612897.zip	2016/11/04 21:14	25,5 KB
R1-1612898.zip	2016/11/04 21:14	27,3 KB
R1-1612899.zip	2016/11/04 21:15	24,6 KB
R1-1612900.zip	2016/11/04 21:16	164,6 KB
R1-1612901.zip	2016/11/04 18:14	25,3 KB
R1-1612902.zip	2016/11/04 18:14	28,4 KB
R1-1612903.zip	2016/11/04 17:15	12,1 KB
R1-1612904.zip	2016/11/04 17:15	20 KB
R1-1612905.zip	2016/11/04 17:15	13,7 KB
R1-1612906.zip	2016/11/04 17:15	12,4 KB
R1-1612907.zip	2016/11/04 17:15	18,6 KB
R1-1612908.zip	2016/11/13 2:20	79,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1612909.zip	2016/11/04 17:15	26 KB
R1-1612910.zip	2016/11/04 17:15	16,5 KB
R1-1612911.zip	2016/11/04 17:15	17,1 KB
R1-1612912.zip	2016/11/04 17:15	17,1 KB
R1-1612913.zip	2016/11/04 17:15	17,9 KB
R1-1612914.zip	2016/11/04 17:15	16,7 KB
R1-1612915.zip	2016/11/04 17:15	127,5 KB
R1-1612916.zip	2016/11/13 2:20	547,4 KB
R1-1612917.zip	2016/11/04 17:15	28,2 KB
R1-1612918.zip	2016/11/04 17:15	13,6 KB
R1-1612919.zip	2016/11/04 17:15	25,9 KB
R1-1612920.zip	2016/11/04 17:15	24,8 KB
R1-1612921.zip	2016/11/04 17:15	27,7 KB
R1-1612922.zip	2016/11/04 17:15	38,7 KB
R1-1612923.zip	2016/11/04 17:15	82,5 KB
R1-1612924.zip	2016/11/04 17:15	25,2 KB
R1-1612925.zip	2016/11/04 17:15	18,1 KB
R1-1612926.zip	2016/11/04 17:56	21,6 KB
R1-1612927.zip	2016/11/04 17:15	19,6 KB
R1-1612928.zip	2016/11/04 12:42	64,2 KB
R1-1612929.zip	2016/11/05 0:47	181,2 KB
R1-1612930.zip	2016/11/05 0:47	50,1 KB
R1-1612931.zip	2016/11/04 19:36	24,3 KB
R1-1612932.zip	2016/11/05 0:47	174,9 KB
R1-1612933.zip	2016/11/05 0:47	62,9 KB
R1-1612934.zip	2016/11/05 0:47	81,7 KB
R1-1612935.zip	2016/11/04 13:00	259,9 KB
R1-1612936.zip	2016/11/05 0:47	60,9 KB
R1-1612937.zip	2016/11/04 13:00	25,3 KB
R1-1612938.zip	2016/11/04 16:26	1178,8 KB
R1-1612939.zip	2016/11/05 0:47	69,9 KB
R1-1612940.zip	2016/11/05 0:49	67,5 KB
R1-1612941.zip	2016/11/04 20:27	38,9 KB
R1-1612942.zip	2016/11/04 21:07	180,3 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1612943.zip	2016/11/04 21:07	24,8 KB
R1-1612945.zip	2016/11/04 20:24	259,7 KB
R1-1612947.zip	2016/11/04 20:27	118,7 KB
R1-1612948.zip	2016/11/05 0:49	273,8 KB
R1-1612949.zip	2016/11/04 21:07	119,4 KB
R1-1612950.zip	2016/11/04 21:07	19,2 KB
R1-1612951.zip	2016/11/05 0:49	55,6 KB
R1-1612952.zip	2016/11/04 20:27	17 KB
R1-1612953.zip	2016/11/04 18:14	37,1 KB
R1-1612954.zip	2016/11/04 15:55	41,1 KB
R1-1612955.zip	2016/11/04 15:55	69,4 KB
R1-1612956.zip	2016/11/04 15:55	34,6 KB
R1-1612957.zip	2016/11/04 15:55	33,3 KB
R1-1612958.zip	2016/11/04 15:55	32,1 KB
R1-1612959.zip	2016/11/05 0:49	80,8 KB
R1-1612960.zip	2016/11/05 0:49	65,7 KB
R1-1612961.zip	2016/11/05 0:49	122,6 KB
R1-1612962.zip	2016/11/04 18:14	62,2 KB
R1-1612963.zip	2016/11/05 0:49	75,1 KB
R1-1612964.zip	2016/11/05 0:49	62,3 KB
R1-1612965.zip	2016/11/05 10:25	27 KB
R1-1612966.zip	2016/11/05 0:49	81,6 KB
R1-1612967.zip	2016/11/04 18:14	73,8 KB
R1-1612969.zip	2016/11/05 0:49	129 KB
R1-1612970.zip	2016/11/05 0:49	59,7 KB
R1-1612971.zip	2016/11/04 18:14	78,1 KB
R1-1612972.zip	2016/11/05 0:49	319,8 KB
R1-1612980.zip	2016/11/19 22:25	72,6 KB
R1-1612981.zip	2016/11/08 14:11	15,4 KB
R1-1612982.zip	2016/11/04 18:14	130,6 KB
R1-1612983.zip	2016/11/04 21:56	51,7 KB
R1-1612984.zip	2016/11/04 21:56	88,8 KB
R1-1612985.zip	2016/11/04 21:56	78 KB
R1-1612986.zip	2016/11/04 19:36	675,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-1612988.zip	2016/11/04 21:16	34 KB
R1-1612989.zip	2016/11/05 17:35	24,2 KB
R1-1612990.zip	2016/11/05 17:35	25,2 KB
R1-1612991.zip	2016/11/05 17:35	23 KB
R1-1612992.zip	2016/11/05 17:35	69,3 KB
R1-1612993.zip	2016/11/04 23:30	21,9 KB
R1-1612994.zip	2016/11/04 18:50	27 KB
R1-1612995.zip	2016/11/04 18:50	26,5 KB
R1-1612996.zip	2016/11/04 18:50	27,3 KB
R1-1612997.zip	2016/11/04 18:50	27,1 KB
R1-1612998.zip	2016/11/04 18:50	21,8 KB
R1-1613000.zip	2016/11/05 5:24	396,5 KB
R1-1613001.zip	2016/11/05 4:40	563,7 KB
R1-1613002.zip	2016/11/05 4:41	119,7 KB
R1-1613003.zip	2016/11/04 18:50	24,5 KB
R1-1613004.zip	2016/11/04 18:50	25,4 KB
R1-1613005.zip	2016/11/04 21:43	827 KB
R1-1613006.zip	2016/11/04 21:52	401,3 KB
R1-1613007.zip	2016/11/05 5:55	90,5 KB
R1-1613008.zip	2016/11/05 5:55	144,9 KB
R1-1613010.zip	2016/11/05 5:55	48 KB
R1-1613011.zip	2016/11/04 23:30	23,3 KB
R1-1613012.zip	2016/11/05 5:55	17,4 KB
R1-1613014.zip	2016/11/05 5:55	68,9 KB
R1-1613015.zip	2016/11/06 5:52	67,4 KB
R1-1613016.zip	2016/11/05 5:55	111,7 KB
R1-1613017.zip	2016/11/09 15:36	212,1 KB
R1-1613018.zip	2016/11/05 0:00	827,4 KB
R1-1613019.zip	2016/11/06 2:00	37,6 KB
R1-1613020.zip	2016/11/06 2:00	51,9 KB
R1-1613021.zip	2016/11/05 4:08	105 KB
R1-1613022.zip	2016/11/05 4:08	104,4 KB
R1-1613023.zip	2016/11/05 4:05	91,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613024.zip	2016/11/05 9:06	21,8 KB
R1-1613025.zip	2016/11/05 9:06	31,4 KB
R1-1613026.zip	2016/11/07 19:41	73,4 KB
R1-1613027.zip	2016/11/08 14:11	637,2 KB
R1-1613028.zip	2016/11/08 14:11	123,3 KB
R1-1613029.zip	2016/11/10 17:48	1575,9 KB
R1-1613030.zip	2016/11/08 14:11	184,8 KB
R1-1613031.zip	2016/11/08 14:11	837,3 KB
R1-1613032.zip	2016/11/13 2:20	66,9 KB
R1-1613033.zip	2016/11/09 15:35	445,4 KB
R1-1613034.zip	2016/11/10 10:11	78,3 KB
R1-1613035.zip	2016/11/11 10:29	151,5 KB
R1-1613036.zip	2016/11/11 10:30	72,7 KB
R1-1613037.zip	2016/11/11 10:29	37,5 KB
R1-1613038.zip	2016/11/10 17:48	22,9 KB
R1-1613039.zip	2016/11/10 17:48	23 KB
R1-1613040.zip	2016/11/10 0:55	107,7 KB
R1-1613041.zip	2016/11/11 10:29	116,4 KB
R1-1613042.zip	2016/11/11 10:29	271,3 KB
R1-1613043.zip	2016/11/11 10:29	1164,3 KB
R1-1613044.zip	2016/11/19 22:26	7678,4 KB
R1-1613045.zip	2016/11/11 10:29	175,1 KB
R1-1613046.zip	2016/11/14 14:17	254,3 KB
R1-1613047.zip	2016/11/10 17:49	102,6 KB
R1-1613048.zip	2016/11/11 12:35	65,7 KB
R1-1613049.zip	2016/11/11 10:29	445,7 KB
R1-1613050.zip	2016/11/11 22:27	534,8 KB
R1-1613051.zip	2016/11/11 22:27	24,9 KB
R1-1613052.zip	2016/11/11 22:27	25,3 KB
R1-1613053.zip	2016/11/19 22:25	19,7 KB
R1-1613054.zip	2016/11/19 22:25	32,9 KB
R1-1613055.zip	2016/11/11 22:27	1127,5 KB
R1-1613056.zip	2017/01/06 9:55	2966,6 KB
R1-1613057.zip	2016/11/11 22:27	139,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613058.zip	2016/11/11 22:27	422,9 KB
R1-1613059.zip	2016/11/19 22:25	640,1 KB
R1-1613060.zip	2016/11/19 22:25	375,5 KB
R1-1613061.zip	2016/11/19 22:25	190,9 KB
R1-1613062.zip	2016/11/11 11:16	320,2 KB
R1-1613063.zip	2016/11/19 22:25	24,6 KB
R1-1613064.zip	2016/11/19 22:25	73,9 KB
R1-1613065.zip	2016/11/19 22:25	30,9 KB
R1-1613066.zip	2016/11/19 22:25	194,5 KB
R1-1613067.zip	2016/11/13 23:23	63,8 KB
R1-1613069.zip	2016/11/30 10:08	83,1 KB
R1-1613070.zip	2016/11/11 20:40	61,7 KB
R1-1613071.zip	2016/11/19 22:25	48,2 KB
R1-1613072.zip	2016/11/13 15:13	539,7 KB
R1-1613073.zip	2016/11/13 15:13	37,3 KB
R1-1613074.zip	2016/11/13 15:13	53,2 KB
R1-1613075.zip	2016/11/13 15:12	80,3 KB
R1-1613076.zip	2016/11/13 15:12	46,6 KB
R1-1613077.zip	2016/11/13 15:12	159,3 KB
R1-1613078.zip	2016/11/13 2:20	360,1 KB
R1-1613079.zip	2016/11/14 14:17	208,8 KB
R1-1613080.zip	2016/11/14 14:17	119,2 KB
R1-1613081.zip	2016/11/14 14:17	234,9 KB
R1-1613084.zip	2016/11/19 22:25	316,1 KB
R1-1613085.zip	2016/11/19 22:25	302 KB
R1-1613086.zip	2016/11/19 22:25	365,7 KB
R1-1613087.zip	2016/11/19 22:25	59,3 KB
R1-1613088.zip	2016/11/19 22:25	89,6 KB
R1-1613089.zip	2016/11/19 22:25	190,8 KB
R1-1613091.zip	2016/11/19 22:25	131,1 KB
R1-1613092.zip	2016/11/19 22:25	194,1 KB
R1-1613093.zip	2016/11/19 22:25	31,7 KB
R1-1613095.zip	2016/11/19 22:25	210,1 KB
R1-1613097.zip	2016/11/19 22:25	30,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613098.zip	2016/11/15 14:08	13,3 KB
R1-1613099.zip	2016/11/19 22:25	46,7 KB
R1-1613100.zip	2016/11/19 22:25	217,1 KB
R1-1613101.zip	2016/11/19 22:25	43,9 KB
R1-1613102.zip	2016/11/19 22:25	82,3 KB
R1-1613103.zip	2016/11/19 22:25	115,2 KB
R1-1613104.zip	2016/11/19 22:25	227,8 KB
R1-1613105.zip	2016/11/19 22:25	163,6 KB
R1-1613106.zip	2016/11/19 22:24	87,1 KB
R1-1613107.zip	2016/11/19 22:24	35,7 KB
R1-1613108.zip	2016/11/19 22:24	31,7 KB
R1-1613109.zip	2016/11/19 22:24	32,2 KB
R1-1613110.zip	2016/11/19 22:24	32,1 KB
R1-1613111.zip	2016/11/19 22:24	34,5 KB
R1-1613112.zip	2016/11/19 22:24	63,2 KB
R1-1613115.zip	2016/11/19 22:24	333,1 KB
R1-1613116.zip	2016/11/19 22:24	25,1 KB
R1-1613117.zip	2016/11/19 22:24	34,7 KB
R1-1613118.zip	2016/11/19 22:24	15,6 KB
R1-1613119.zip	2016/11/19 22:24	49,3 KB
R1-1613120.zip	2016/11/19 22:24	37,5 KB
R1-1613121.zip	2016/11/19 22:24	1282,3 KB
R1-1613122.zip	2016/11/19 22:24	264,5 KB
R1-1613123.zip	2016/11/19 22:24	87,9 KB
R1-1613124.zip	2016/11/19 22:24	134,9 KB
R1-1613125.zip	2016/11/19 22:24	34,8 KB
R1-1613126.zip	2016/11/15 14:08	409,2 KB
R1-1613127.zip	2016/11/19 22:24	21,3 KB
R1-1613128.zip	2016/11/19 22:24	34,9 KB
R1-1613129.zip	2016/11/19 22:24	33,3 KB
R1-1613130.zip	2016/11/19 22:24	32,4 KB
R1-1613131.zip	2016/11/19 22:24	32,2 KB
R1-1613132.zip	2016/11/19 22:24	31,6 KB
R1-1613133.zip	2016/11/19 22:24	85,5 KB

Petitioners' Exhibit 1007, p. 1151
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1613134.zip	2016/11/21 7:28	29,6 KB
R1-1613135.zip	2016/11/19 22:24	61,8 KB
R1-1613136.zip	2016/11/19 22:24	53,9 KB
R1-1613137.zip	2016/11/19 22:24	22,1 KB
R1-1613138.zip	2016/11/19 22:24	59,1 KB
R1-1613139.zip	2016/11/19 22:24	23,3 KB
R1-1613140.zip	2016/11/19 22:24	23,4 KB
R1-1613141.zip	2016/11/19 22:24	24,5 KB
R1-1613143.zip	2016/11/19 22:24	32,4 KB
R1-1613144.zip	2016/11/19 22:24	31,2 KB
R1-1613146.zip	2016/11/19 22:24	53,9 KB
R1-1613147.zip	2016/11/19 22:24	53,9 KB
R1-1613148.zip	2016/11/19 22:24	60,8 KB
R1-1613149.zip	2016/11/19 22:24	35 KB
R1-1613150.zip	2016/11/19 22:24	28,1 KB
R1-1613151.zip	2016/11/19 22:24	550,1 KB
R1-1613152.zip	2016/11/19 22:24	31,7 KB
R1-1613153.zip	2016/11/29 9:07	38,1 KB
R1-1613154.zip	2016/11/29 9:07	36,7 KB
R1-1613155.zip	2016/11/19 22:24	40,9 KB
R1-1613156.zip	2016/11/19 22:24	34,2 KB
R1-1613157.zip	2016/11/19 22:24	32 KB
R1-1613158.zip	2016/11/19 22:24	36,1 KB
R1-1613159.zip	2016/11/19 22:24	37,6 KB
R1-1613160.zip	2016/11/19 22:24	51 KB
R1-1613161.zip	2016/11/19 22:24	80,8 KB
R1-1613162.zip	2016/11/19 22:24	552,3 KB
R1-1613163.zip	2016/11/19 22:23	100,6 KB
R1-1613164.zip	2016/11/19 22:23	33,6 KB
R1-1613165.zip	2016/11/19 22:23	1266,4 KB
R1-1613166.zip	2016/11/19 22:23	139,6 KB
R1-1613167.zip	2016/11/19 22:23	33,7 KB
R1-1613168.zip	2016/11/19 22:23	34,8 KB
R1-1613169.zip	2016/11/19 22:23	26,7 KB

Petitioners' Exhibit 1007, p. 1152
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1613170.zip	2016/11/19 22:23	508,5 KB
R1-1613171.zip	2016/11/19 22:23	54,6 KB
R1-1613172.zip	2016/11/19 22:23	47,6 KB
R1-1613173.zip	2016/11/19 22:23	51,2 KB
R1-1613174.zip	2016/11/19 22:23	51,7 KB
R1-1613175.zip	2016/11/19 22:23	54,7 KB
R1-1613176.zip	2016/11/19 22:23	65,7 KB
R1-1613177.zip	2016/11/19 22:23	32,3 KB
R1-1613178.zip	2016/11/19 22:23	43,7 KB
R1-1613179.zip	2016/11/19 22:23	35,9 KB
R1-1613180.zip	2016/11/19 22:23	51,9 KB
R1-1613181.zip	2016/11/19 22:23	34,9 KB
R1-1613182.zip	2016/11/19 22:23	40,8 KB
R1-1613183.zip	2016/11/19 22:23	96,4 KB
R1-1613184.zip	2016/11/19 22:23	95,1 KB
R1-1613185.zip	2016/11/19 22:23	98,2 KB
R1-1613186.zip	2016/11/19 22:23	34,9 KB
R1-1613188.zip	2016/11/19 22:23	55,2 KB
R1-1613189.zip	2016/11/19 22:23	45,6 KB
R1-1613190.zip	2016/11/19 22:23	123,4 KB
R1-1613191.zip	2016/11/19 22:23	42,1 KB
R1-1613192.zip	2016/11/19 22:23	36,4 KB
R1-1613193.zip	2016/11/19 22:23	40,7 KB
R1-1613194.zip	2016/11/19 22:23	28 KB
R1-1613195.zip	2016/11/19 22:23	87,7 KB
R1-1613196.zip	2016/11/19 22:23	41 KB
R1-1613197.zip	2016/11/19 22:23	48,2 KB
R1-1613198.zip	2016/11/19 22:23	44,5 KB
R1-1613199.zip	2016/11/19 22:23	44,6 KB
R1-1613200.zip	2016/11/19 22:23	57,5 KB
R1-1613201.zip	2016/11/19 22:23	41,8 KB
R1-1613202.zip	2016/11/19 22:23	24,4 KB
R1-1613203.zip	2016/11/19 22:23	24,3 KB
R1-1613204.zip	2016/11/19 22:23	23,2 KB

Petitioners' Exhibit 1007, p. 1153
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613205.zip	2016/11/19 22:23	23,2 KB
R1-1613206.zip	2016/11/19 22:23	200,4 KB
R1-1613207.zip	2016/11/19 22:23	22 KB
R1-1613208.zip	2016/11/19 22:23	12,3 KB
R1-1613210.zip	2016/11/19 22:23	63,3 KB
R1-1613211.zip	2016/11/19 22:23	90,7 KB
R1-1613212.zip	2016/11/19 22:23	55,7 KB
R1-1613213.zip	2016/11/19 22:23	56,1 KB
R1-1613214.zip	2016/11/19 22:23	52,5 KB
R1-1613215.zip	2016/11/19 22:22	42 KB
R1-1613216.zip	2016/11/19 22:22	31 KB
R1-1613217.zip	2016/11/19 22:22	31,4 KB
R1-1613218.zip	2016/11/19 22:22	192,3 KB
R1-1613219.zip	2016/11/19 22:22	35,8 KB
R1-1613220.zip	2016/11/19 22:22	37 KB
R1-1613221.zip	2016/11/19 22:22	36,5 KB
R1-1613222.zip	2016/11/19 22:22	30 KB
R1-1613223.zip	2016/11/19 22:22	53,6 KB
R1-1613224.zip	2016/11/19 22:22	52 KB
R1-1613225.zip	2016/11/19 22:22	55 KB
R1-1613226.zip	2016/11/19 22:22	120,9 KB
R1-1613227.zip	2016/11/19 22:22	42,3 KB
R1-1613228.zip	2016/11/19 22:22	40,1 KB
R1-1613229.zip	2016/11/19 22:22	46,7 KB
R1-1613230.zip	2016/11/19 22:22	48,4 KB
R1-1613231.zip	2016/11/19 22:22	55 KB
R1-1613232.zip	2016/11/19 22:22	156,8 KB
R1-1613233.zip	2016/11/19 22:22	36,1 KB
R1-1613234.zip	2016/11/19 22:22	109,4 KB
R1-1613235.zip	2016/11/19 22:22	48,1 KB
R1-1613236.zip	2016/11/19 22:22	54,4 KB
R1-1613237.zip	2016/11/19 22:22	40,8 KB
R1-1613238.zip	2016/11/19 22:22	52,3 KB
R1-1613239.zip	2016/11/19 22:22	65 KB

Petitioners' Exhibit 1007, p. 1154
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613240.zip	2016/11/19 22:22	38,9 KB
R1-1613241.zip	2016/11/19 22:22	34,9 KB
R1-1613242.zip	2016/11/19 22:22	291,2 KB
R1-1613243.zip	2016/11/19 22:22	54 KB
R1-1613244.zip	2016/11/19 22:22	104,8 KB
R1-1613245.zip	2016/11/19 22:22	104 KB
R1-1613246.zip	2016/11/19 22:22	306,1 KB
R1-1613248.zip	2016/11/19 22:22	38,7 KB
R1-1613249.zip	2016/11/19 22:22	34,5 KB
R1-1613250.zip	2016/11/19 22:22	44,9 KB
R1-1613251.zip	2016/11/29 9:01	60,8 KB
R1-1613252.zip	2016/11/19 22:22	37,2 KB
R1-1613253.zip	2016/11/19 22:22	37,2 KB
R1-1613254.zip	2016/11/19 22:22	76,8 KB
R1-1613255.zip	2016/11/19 22:22	76,7 KB
R1-1613256.zip	2016/11/19 22:22	53,8 KB
R1-1613257.zip	2016/11/19 22:22	21,5 KB
R1-1613258.zip	2016/11/19 22:22	32,8 KB
R1-1613259.zip	2016/11/22 14:29	55,7 KB
R1-1613260.zip	2016/11/22 14:29	56,2 KB
R1-1613261.zip	2016/11/19 22:22	31,3 KB
R1-1613262.zip	2016/11/19 22:22	204,9 KB
R1-1613263.zip	2016/11/19 22:22	75,3 KB
R1-1613264.zip	2016/11/19 22:22	218 KB
R1-1613265.zip	2016/11/19 22:22	181,9 KB
R1-1613266.zip	2016/11/19 22:22	49,6 KB
R1-1613267.zip	2016/11/19 22:22	437,2 KB
R1-1613268.zip	2016/11/19 22:22	104,2 KB
R1-1613269.zip	2016/11/19 22:22	42 KB
R1-1613270.zip	2016/11/19 22:21	29,6 KB
R1-1613271.zip	2016/11/19 22:21	76,7 KB
R1-1613272.zip	2016/11/19 22:21	32,7 KB
R1-1613273.zip	2016/11/19 22:21	103,6 KB
R1-1613274.zip	2016/11/19 22:21	52 KB

Petitioners' Exhibit 1007, p. 1155
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613275.zip	2016/11/19 22:21	236,2 KB
R1-1613276.zip	2016/11/19 22:21	49,9 KB
R1-1613277.zip	2016/11/19 22:21	53,8 KB
R1-1613278.zip	2016/11/19 22:21	65,3 KB
R1-1613279.zip	2016/11/19 22:21	44,6 KB
R1-1613280.zip	2016/11/19 22:21	44,8 KB
R1-1613281.zip	2016/11/19 22:21	35,2 KB
R1-1613282.zip	2016/11/19 22:21	34,1 KB
R1-1613283.zip	2016/11/19 22:21	31,9 KB
R1-1613284.zip	2016/11/19 22:21	337,2 KB
R1-1613285.zip	2016/11/19 22:21	350,3 KB
R1-1613286.zip	2016/11/19 22:21	31,1 KB
R1-1613287.zip	2016/11/19 22:21	23,6 KB
R1-1613288.zip	2016/11/19 22:21	24,4 KB
R1-1613290.zip	2016/11/19 22:21	27,8 KB
R1-1613291.zip	2016/11/19 22:21	38,5 KB
R1-1613292.zip	2016/11/19 22:21	55,1 KB
R1-1613293.zip	2016/11/19 22:21	65,9 KB
R1-1613294.zip	2016/11/19 22:21	285,4 KB
R1-1613295.zip	2016/11/19 22:21	41,1 KB
R1-1613296.zip	2016/11/19 22:21	42,4 KB
R1-1613297.zip	2016/11/19 22:21	72,9 KB
R1-1613299.zip	2016/11/19 22:21	374 KB
R1-1613300.zip	2016/11/19 22:21	317,1 KB
R1-1613301.zip	2016/11/19 22:21	5706 KB
R1-1613302.zip	2016/11/19 22:21	1085,5 KB
R1-1613303.zip	2016/11/19 22:20	194,4 KB
R1-1613304.zip	2016/11/19 22:20	909,5 KB
R1-1613305.zip	2016/11/19 22:20	634,1 KB
R1-1613306.zip	2016/11/19 22:20	141 KB
R1-1613307.zip	2016/11/19 22:20	90,6 KB
R1-1613308.zip	2016/11/19 22:20	51,8 KB
R1-1613309.zip	2016/11/19 22:20	325,2 KB
R1-1613310.zip	2016/11/19 22:20	40,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613311.zip	2016/11/19 22:20	105,6 KB
R1-1613312.zip	2016/11/19 22:20	55,9 KB
R1-1613313.zip	2016/11/19 22:20	66,7 KB
R1-1613314.zip	2016/11/19 22:20	30,9 KB
R1-1613315.zip	2016/11/19 22:20	104 KB
R1-1613316.zip	2016/11/19 22:20	13,9 KB
R1-1613317.zip	2016/11/19 22:20	13 KB
R1-1613318.zip	2016/11/19 22:20	41,8 KB
R1-1613319.zip	2016/11/19 22:20	32,8 KB
R1-1613320.zip	2016/11/19 22:20	32,6 KB
R1-1613321.zip	2016/11/19 22:20	141,6 KB
R1-1613322.zip	2016/11/19 22:20	33 KB
R1-1613323.zip	2016/11/19 22:20	13,8 KB
R1-1613324.zip	2016/11/19 22:20	89,8 KB
R1-1613325.zip	2016/11/19 22:20	33,2 KB
R1-1613326.zip	2016/11/19 22:20	29,8 KB
R1-1613327.zip	2016/11/19 22:20	37,8 KB
R1-1613328.zip	2016/11/19 22:20	39,9 KB
R1-1613329.zip	2016/11/19 22:20	52,2 KB
R1-1613330.zip	2016/11/19 22:20	46,9 KB
R1-1613331.zip	2016/11/19 22:20	141,6 KB
R1-1613334.zip	2016/11/19 22:20	34,7 KB
R1-1613335.zip	2016/11/19 22:20	35,1 KB
R1-1613336.zip	2016/11/19 22:20	44,9 KB
R1-1613338.zip	2016/11/19 22:20	37,1 KB
R1-1613339.zip	2016/11/19 22:20	33,7 KB
R1-1613340.zip	2016/11/19 22:20	48,7 KB
R1-1613341.zip	2016/11/19 22:20	414,4 KB
R1-1613342.zip	2016/11/19 22:20	61,2 KB
R1-1613343.zip	2016/11/19 22:20	376,1 KB
R1-1613344.zip	2016/11/19 22:20	56 KB
R1-1613345.zip	2016/11/19 22:20	32,2 KB
R1-1613346.zip	2016/11/19 22:20	44,4 KB
R1-1613347.zip	2016/11/19 22:20	163,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613348.zip	2016/11/19 22:19	13,4 KB
R1-1613349.zip	2016/11/19 22:20	163,7 KB
R1-1613350.zip	2016/11/19 22:19	31,3 KB
R1-1613351.zip	2016/11/19 22:19	123,7 KB
R1-1613352.zip	2016/11/19 22:19	367,2 KB
R1-1613353.zip	2016/11/19 22:19	42,1 KB
R1-1613354.zip	2016/11/19 22:19	25,8 KB
R1-1613355.zip	2016/11/19 22:19	30,4 KB
R1-1613356.zip	2016/11/19 22:19	40,8 KB
R1-1613357.zip	2016/11/19 22:19	28,8 KB
R1-1613358.zip	2016/11/19 22:19	28,9 KB
R1-1613359.zip	2016/11/19 22:19	110,7 KB
R1-1613361.zip	2016/11/19 22:19	41,6 KB
R1-1613362.zip	2016/11/19 22:19	29,3 KB
R1-1613363.zip	2016/11/19 22:19	130,6 KB
R1-1613364.zip	2016/11/19 22:19	36,1 KB
R1-1613365.zip	2016/11/19 22:19	108,8 KB
R1-1613366.zip	2016/11/19 22:19	265 KB
R1-1613367.zip	2016/11/19 22:19	103,5 KB
R1-1613368.zip	2016/11/19 22:19	101,2 KB
R1-1613369.zip	2016/11/19 22:19	50,4 KB
R1-1613370.zip	2016/11/19 22:19	43,5 KB
R1-1613371.zip	2016/11/19 22:19	38,4 KB
R1-1613372.zip	2016/11/19 22:19	62,2 KB
R1-1613373.zip	2016/11/19 22:19	41,4 KB
R1-1613374.zip	2016/11/19 22:19	41,3 KB
R1-1613375.zip	2016/11/19 22:19	66,4 KB
R1-1613376.zip	2016/11/19 22:19	28,8 KB
R1-1613378.zip	2016/11/19 22:19	26,5 KB
R1-1613380.zip	2016/11/19 22:19	35,1 KB
R1-1613381.zip	2016/11/19 22:19	30,3 KB
R1-1613382.zip	2016/11/19 22:19	69,1 KB
R1-1613383.zip	2016/11/19 22:19	96,7 KB
R1-1613384.zip	2016/11/19 22:19	83,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613385.zip	2016/11/19 22:19	38,2 KB
R1-1613387.zip	2016/11/19 22:19	37,8 KB
R1-1613388.zip	2016/11/19 22:19	76,9 KB
R1-1613389.zip	2016/11/19 22:19	63,4 KB
R1-1613390.zip	2016/11/19 22:19	39,1 KB
R1-1613391.zip	2016/11/19 22:19	37 KB
R1-1613392.zip	2016/11/19 22:19	51,8 KB
R1-1613393.zip	2016/11/19 22:19	33,4 KB
R1-1613394.zip	2016/11/19 22:19	40,9 KB
R1-1613395.zip	2016/11/19 22:19	33 KB
R1-1613396.zip	2016/11/19 22:19	30,4 KB
R1-1613397.zip	2016/11/19 22:19	87,9 KB
R1-1613398.zip	2016/11/19 22:19	67,7 KB
R1-1613399.zip	2016/11/19 22:19	32,4 KB
R1-1613400.zip	2016/11/19 22:19	67,2 KB
R1-1613401.zip	2016/11/19 22:19	83,5 KB
R1-1613402.zip	2016/11/19 22:19	39,3 KB
R1-1613403.zip	2016/11/19 22:19	51,6 KB
R1-1613404.zip	2016/11/19 22:19	38,4 KB
R1-1613405.zip	2016/11/19 22:18	39,1 KB
R1-1613406.zip	2016/11/19 22:18	104,9 KB
R1-1613407.zip	2016/11/19 22:18	39,3 KB
R1-1613408.zip	2016/11/19 22:18	39,5 KB
R1-1613409.zip	2016/11/19 22:18	38,4 KB
R1-1613410.zip	2016/11/19 22:18	38,5 KB
R1-1613411.zip	2016/11/19 22:18	32,3 KB
R1-1613412.zip	2016/11/19 22:18	51,2 KB
R1-1613413.zip	2016/11/19 22:18	33,9 KB
R1-1613414.zip	2016/11/19 22:18	28,8 KB
R1-1613415.zip	2016/11/19 22:18	30,7 KB
R1-1613416.zip	2016/11/19 22:18	15,5 KB
R1-1613417.zip	2016/11/19 22:18	41,4 KB
R1-1613418.zip	2016/11/19 22:18	109,4 KB
R1-1613419.zip	2016/11/19 22:18	17,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613421.zip	2016/11/19 22:18	18,6 KB
R1-1613422.zip	2016/11/19 22:18	37,6 KB
R1-1613423.zip	2016/11/19 22:18	67,8 KB
R1-1613424.zip	2016/11/19 22:18	39,7 KB
R1-1613425.zip	2016/11/19 22:18	46,6 KB
R1-1613426.zip	2016/11/19 22:18	25,8 KB
R1-1613427.zip	2016/11/19 22:18	37,1 KB
R1-1613429.zip	2016/11/19 22:18	33,7 KB
R1-1613430.zip	2016/11/19 22:18	47,6 KB
R1-1613431.zip	2016/11/19 22:18	33,5 KB
R1-1613432.zip	2016/11/19 22:18	3248,4 KB
R1-1613433.zip	2016/11/19 22:18	404,9 KB
R1-1613434.zip	2016/11/19 22:18	48,9 KB
R1-1613435.zip	2016/11/19 22:18	46,7 KB
R1-1613436.zip	2016/11/19 22:18	44,8 KB
R1-1613438.zip	2016/11/19 22:18	48,5 KB
R1-1613439.zip	2016/11/19 22:18	50,4 KB
R1-1613440.zip	2016/11/19 22:18	48,9 KB
R1-1613441.zip	2016/11/19 22:18	57,6 KB
R1-1613443.zip	2016/11/19 22:18	29,3 KB
R1-1613444.zip	2016/11/19 22:18	106,6 KB
R1-1613445.zip	2016/11/19 22:18	27,6 KB
R1-1613446.zip	2016/11/19 22:18	17,1 KB
R1-1613447.zip	2016/11/19 22:18	93,4 KB
R1-1613448.zip	2016/11/19 22:18	32,3 KB
R1-1613449.zip	2016/11/19 22:18	32,4 KB
R1-1613450.zip	2016/11/19 22:18	44,3 KB
R1-1613451.zip	2016/11/19 22:18	37,8 KB
R1-1613452.zip	2016/11/19 22:17	31,7 KB
R1-1613453.zip	2016/11/19 22:17	45,6 KB
R1-1613454.zip	2016/11/19 22:17	10,4 KB
R1-1613455.zip	2016/11/19 22:17	30,5 KB
R1-1613456.zip	2016/11/19 22:17	33,2 KB
R1-1613457.zip	2016/11/19 22:17	31,2 KB

Petitioners' Exhibit 1007, p. 1160
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1613458.zip	2016/11/19 22:17	31,5 KB
R1-1613459.zip	2016/11/19 22:17	31 KB
R1-1613460.zip	2016/11/19 22:17	32,6 KB
R1-1613461.zip	2016/11/19 22:17	33,9 KB
R1-1613462.zip	2016/11/19 22:17	34,3 KB
R1-1613463.zip	2016/11/19 22:17	36 KB
R1-1613464.zip	2016/11/19 22:17	36,5 KB
R1-1613465.zip	2016/11/19 22:17	45,3 KB
R1-1613466.zip	2016/11/19 22:17	45,4 KB
R1-1613467.zip	2016/11/19 22:17	31,5 KB
R1-1613468.zip	2016/11/19 22:17	31,5 KB
R1-1613469.zip	2016/11/19 22:17	156,8 KB
R1-1613470.zip	2016/11/19 22:17	42,3 KB
R1-1613471.zip	2016/11/19 22:17	28,8 KB
R1-1613472.zip	2016/11/19 22:17	48,5 KB
R1-1613473.zip	2016/11/19 22:17	104,5 KB
R1-1613474.zip	2016/11/19 22:17	49,3 KB
R1-1613476.zip	2016/11/19 22:17	78 KB
R1-1613477.zip	2016/11/19 22:17	367,9 KB
R1-1613478.zip	2016/11/19 22:17	40 KB
R1-1613479.zip	2016/11/19 22:17	40,2 KB
R1-1613480.zip	2016/11/19 22:17	48,2 KB
R1-1613481.zip	2016/11/19 22:17	17,9 KB
R1-1613482.zip	2016/11/19 22:17	139,7 KB
R1-1613483.zip	2016/11/19 22:17	34,2 KB
R1-1613484.zip	2016/11/19 22:17	28,8 KB
R1-1613485.zip	2016/11/19 22:17	26,1 KB
R1-1613486.zip	2016/11/19 22:17	50 KB
R1-1613487.zip	2016/11/19 22:17	67,3 KB
R1-1613490.zip	2016/11/19 22:17	15,2 KB
R1-1613491.zip	2016/11/19 22:17	23,7 KB
R1-1613492.zip	2016/11/19 22:17	39,7 KB
R1-1613493.zip	2016/11/19 22:17	13 KB
R1-1613494.zip	2016/11/19 22:17	11,5 KB

Petitioners' Exhibit 1007, p. 1161
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1613495.zip	2016/11/19 22:17	12,6 KB
R1-1613496.zip	2016/11/29 9:00	75,4 KB
R1-1613497.zip	2016/11/19 22:17	76,2 KB
R1-1613502.zip	2016/11/19 22:17	65,2 KB
R1-1613503.zip	2016/11/19 22:17	38,8 KB
R1-1613504.zip	2016/11/19 22:17	29 KB
R1-1613505.zip	2016/11/19 22:17	37,9 KB
R1-1613506.zip	2016/11/19 22:17	46,6 KB
R1-1613507.zip	2016/11/19 22:17	493 KB
R1-1613508.zip	2016/11/19 22:17	136,4 KB
R1-1613509.zip	2016/11/19 22:17	29,3 KB
R1-1613510.zip	2016/11/19 22:17	85,5 KB
R1-1613511.zip	2016/11/19 22:16	32 KB
R1-1613512.zip	2016/11/19 22:16	46,8 KB
R1-1613513.zip	2016/11/19 22:16	33,8 KB
R1-1613514.zip	2016/11/19 22:16	31,5 KB
R1-1613515.zip	2016/11/19 22:16	30,1 KB
R1-1613516.zip	2016/11/19 22:16	56,3 KB
R1-1613517.zip	2016/11/19 22:16	401,3 KB
R1-1613518.zip	2016/11/19 22:16	35,9 KB
R1-1613519.zip	2016/11/19 22:16	37,1 KB
R1-1613520.zip	2016/11/19 22:16	26,2 KB
R1-1613521.zip	2016/11/19 22:16	38,3 KB
R1-1613522.zip	2016/11/19 22:16	69,6 KB
R1-1613523.zip	2016/11/19 22:16	32,6 KB
R1-1613524.zip	2016/11/19 22:16	30,2 KB
R1-1613525.zip	2016/11/19 22:16	73,4 KB
R1-1613526.zip	2016/11/19 22:16	43,9 KB
R1-1613527.zip	2016/11/19 22:16	80,6 KB
R1-1613528.zip	2016/11/19 22:16	37,9 KB
R1-1613529.zip	2016/11/19 22:16	34,1 KB
R1-1613530.zip	2016/11/19 22:16	78,1 KB
R1-1613531.zip	2016/11/19 22:16	42,4 KB
R1-1613532.zip	2016/11/19 22:16	386,9 KB

Petitioners' Exhibit 1007, p. 1162
AT&T et al v. Asustek Technology & Celerity
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613533.zip	2016/11/19 22:16	76,6 KB
R1-1613534.zip	2016/11/19 22:16	367,6 KB
R1-1613535.zip	2016/11/19 22:16	149,2 KB
R1-1613536.zip	2016/11/19 22:16	397 KB
R1-1613537.zip	2016/11/19 22:16	83,9 KB
R1-1613538.zip	2016/11/19 22:16	46,1 KB
R1-1613539.zip	2016/11/19 22:16	28,4 KB
R1-1613540.zip	2016/11/19 22:16	55,3 KB
R1-1613541.zip	2016/11/19 22:16	36,5 KB
R1-1613542.zip	2016/11/19 22:16	34,8 KB
R1-1613543.zip	2016/11/19 22:16	46,1 KB
R1-1613544.zip	2016/11/19 22:16	85,2 KB
R1-1613545.zip	2016/11/19 22:16	109 KB
R1-1613546.zip	2016/11/19 22:16	35,9 KB
R1-1613547.zip	2016/11/19 22:16	48,2 KB
R1-1613548.zip	2016/11/19 22:16	51,6 KB
R1-1613549.zip	2016/11/19 22:16	30,9 KB
R1-1613550.zip	2016/11/19 22:16	30,6 KB
R1-1613551.zip	2016/11/19 22:16	50,1 KB
R1-1613552.zip	2016/11/19 22:16	40,9 KB
R1-1613553.zip	2016/11/19 22:16	38,9 KB
R1-1613554.zip	2016/11/19 22:16	23,6 KB
R1-1613556.zip	2016/11/19 22:16	32,4 KB
R1-1613559.zip	2016/11/19 22:16	32,8 KB
R1-1613560.zip	2016/11/19 22:15	32,4 KB
R1-1613561.zip	2016/11/19 22:16	390,2 KB
R1-1613562.zip	2016/11/19 22:15	58,2 KB
R1-1613563.zip	2016/11/19 22:15	25,9 KB
R1-1613564.zip	2016/11/19 22:15	33 KB
R1-1613565.zip	2016/11/19 22:15	43,7 KB
R1-1613566.zip	2016/11/19 22:15	43,6 KB
R1-1613567.zip	2016/11/19 22:15	40,5 KB
R1-1613568.zip	2016/11/19 22:15	30,8 KB
R1-1613569.zip	2016/11/19 22:15	30,7 KB

Petitioners' Exhibit 1007, p. 1163
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613570.zip	2016/11/19 22:15	32,1 KB
R1-1613571.zip	2016/11/19 22:15	29,7 KB
R1-1613572.zip	2016/11/19 22:15	29,9 KB
R1-1613573.zip	2016/11/19 22:15	14,6 KB
R1-1613574.zip	2016/11/19 22:15	14,9 KB
R1-1613575.zip	2016/11/19 22:15	29,6 KB
R1-1613576.zip	2016/11/19 22:15	273,9 KB
R1-1613577.zip	2016/11/19 22:15	31,3 KB
R1-1613578.zip	2016/11/19 22:15	35,9 KB
R1-1613580.zip	2016/11/19 22:15	48,4 KB
R1-1613581.zip	2016/11/19 22:15	24,4 KB
R1-1613582.zip	2016/11/19 22:15	31,5 KB
R1-1613583.zip	2016/11/19 22:15	27,8 KB
R1-1613584.zip	2016/11/19 22:15	1581,9 KB
R1-1613585.zip	2016/11/19 22:15	54,4 KB
R1-1613586.zip	2016/11/19 22:15	31,3 KB
R1-1613587.zip	2016/11/19 22:15	28,4 KB
R1-1613588.zip	2016/11/19 22:15	64,9 KB
R1-1613589.zip	2016/11/19 22:15	49,5 KB
R1-1613590.zip	2016/11/19 22:15	32,9 KB
R1-1613591.zip	2016/11/19 22:15	30 KB
R1-1613592.zip	2016/11/19 22:15	16,8 KB
R1-1613593.zip	2016/11/19 22:15	15 KB
R1-1613594.zip	2016/11/19 22:15	23,4 KB
R1-1613595.zip	2016/11/19 22:15	32,2 KB
R1-1613596.zip	2016/11/19 22:15	51,9 KB
R1-1613597.zip	2016/11/19 22:15	25,3 KB
R1-1613598.zip	2016/11/19 22:15	152,4 KB
R1-1613599.zip	2016/11/19 22:15	37 KB
R1-1613600.zip	2016/11/19 22:15	36,8 KB
R1-1613601.zip	2016/11/19 22:15	30,3 KB
R1-1613602.zip	2016/11/19 22:15	32,2 KB
R1-1613603.zip	2016/11/19 22:15	30,6 KB
R1-1613604.zip	2016/11/19 22:15	71,6 KB

Petitioners' Exhibit 1007, p. 1164
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613605.zip	2016/11/19 22:15	51,7 KB
R1-1613606.zip	2016/11/19 22:15	50 KB
R1-1613608.zip	2016/11/19 22:15	28,6 KB
R1-1613609.zip	2016/11/19 22:15	67 KB
R1-1613610.zip	2016/11/19 22:15	39,2 KB
R1-1613611.zip	2016/11/19 22:15	25,8 KB
R1-1613614.zip	2016/11/19 22:15	16,7 KB
R1-1613615.zip	2016/11/19 22:15	35,8 KB
R1-1613616.zip	2016/11/19 22:15	33,5 KB
R1-1613617.zip	2016/11/19 22:15	10,7 KB
R1-1613618.zip	2016/11/19 22:15	10,8 KB
R1-1613619.zip	2016/11/19 22:15	39,7 KB
R1-1613620.zip	2016/11/19 22:15	76,4 KB
R1-1613621.zip	2016/11/19 22:14	33,6 KB
R1-1613622.zip	2016/11/19 22:14	30,8 KB
R1-1613623.zip	2016/11/19 22:14	31,7 KB
R1-1613624.zip	2016/11/19 22:14	40 KB
R1-1613625.zip	2016/11/19 22:14	53,1 KB
R1-1613628.zip	2016/11/19 22:14	47,8 KB
R1-1613629.zip	2016/11/19 22:14	16,9 KB
R1-1613630.zip	2016/11/19 22:14	55,7 KB
R1-1613632.zip	2016/11/19 22:14	103,8 KB
R1-1613633.zip	2016/11/19 22:14	14,2 KB
R1-1613634.zip	2016/11/19 22:14	44,8 KB
R1-1613635.zip	2016/11/19 22:14	378,6 KB
R1-1613636.zip	2016/11/19 22:14	47,4 KB
R1-1613637.zip	2016/11/19 22:14	2186,9 KB
R1-1613638.zip	2016/11/19 22:14	10 KB
R1-1613639.zip	2016/11/19 22:14	110 KB
R1-1613640.zip	2016/11/19 22:14	40,5 KB
R1-1613641.zip	2016/11/19 22:14	37,7 KB
R1-1613642.zip	2016/11/19 22:14	56,8 KB
R1-1613643.zip	2016/11/19 22:14	59,7 KB
R1-1613644.zip	2016/11/19 22:14	59,7 KB

Petitioners' Exhibit 1007, p. 1165
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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613645.zip	2016/11/19 22:14	190 KB
R1-1613647.zip	2016/11/19 22:14	164,1 KB
R1-1613648.zip	2016/11/19 22:14	49,2 KB
R1-1613649.zip	2016/11/19 22:14	46,6 KB
R1-1613650.zip	2016/11/19 22:14	37,7 KB
R1-1613651.zip	2016/11/19 22:14	65 KB
R1-1613652.zip	2016/11/19 22:14	12,6 KB
R1-1613653.zip	2016/11/19 22:14	83,3 KB
R1-1613654.zip	2016/11/19 22:14	8,5 KB
R1-1613655.zip	2016/11/19 22:14	37,2 KB
R1-1613656.zip	2016/11/19 22:14	55,9 KB
R1-1613657.zip	2016/11/19 22:14	106,4 KB
R1-1613658.zip	2016/11/19 22:14	39,4 KB
R1-1613659.zip	2016/11/19 22:14	11,8 KB
R1-1613660.zip	2016/11/19 22:14	41,1 KB
R1-1613661.zip	2016/11/19 22:14	119,8 KB
R1-1613663.zip	2016/11/19 22:14	11,7 KB
R1-1613664.zip	2016/11/19 22:14	48,9 KB
R1-1613665.zip	2016/11/19 22:14	43,7 KB
R1-1613666.zip	2016/11/19 22:14	41,5 KB
R1-1613667.zip	2016/11/19 22:14	41,6 KB
R1-1613668.zip	2016/11/19 22:14	25,9 KB
R1-1613669.zip	2016/11/19 22:14	123,1 KB
R1-1613670.zip	2016/11/19 22:14	110,4 KB
R1-1613671.zip	2016/11/19 22:14	39,5 KB
R1-1613672.zip	2016/11/19 22:14	58,5 KB
R1-1613673.zip	2016/11/19 22:14	40 KB
R1-1613674.zip	2016/11/19 22:14	31,2 KB
R1-1613675.zip	2016/11/19 22:14	66 KB
R1-1613676.zip	2016/11/19 22:14	34,8 KB
R1-1613677.zip	2016/11/19 22:13	37,4 KB
R1-1613678.zip	2016/11/19 22:13	33,2 KB
R1-1613679.zip	2016/11/19 22:13	43,2 KB
R1-1613680.zip	2016/11/19 22:13	12,4 KB

Petitioners' Exhibit 1007, p. 1166
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-1613681.zip	2016/11/19 22:13	78,9 KB
R1-1613682.zip	2016/11/19 22:13	35,4 KB
R1-1613683.zip	2016/11/19 22:13	43,8 KB
R1-1613684.zip	2016/11/19 22:13	36,4 KB
R1-1613685.zip	2016/11/19 22:13	51,9 KB
R1-1613686.zip	2016/11/19 22:13	36,7 KB
R1-1613687.zip	2016/11/19 22:13	497,2 KB
R1-1613688.zip	2016/11/19 22:13	28,9 KB
R1-1613689.zip	2016/11/19 22:13	34,9 KB
R1-1613690.zip	2016/11/19 22:13	120,9 KB
R1-1613691.zip	2016/11/19 22:13	78 KB
R1-1613692.zip	2016/11/29 9:00	36,7 KB
R1-1613693.zip	2016/11/19 22:13	54,9 KB
R1-1613694.zip	2016/11/19 22:13	43 KB
R1-1613695.zip	2016/11/19 22:13	37,8 KB
R1-1613696.zip	2016/11/19 22:13	36,9 KB
R1-1613697.zip	2016/11/19 22:13	11,5 KB
R1-1613698.zip	2016/11/19 22:13	117 KB
R1-1613699.zip	2016/11/19 22:13	294,9 KB
R1-1613700.zip	2016/11/19 22:13	104,5 KB
R1-1613701.zip	2016/11/19 22:13	117,6 KB
R1-1613702.zip	2016/11/19 22:13	121 KB
R1-1613703.zip	2016/11/19 22:13	194,9 KB
R1-1613704.zip	2016/11/19 22:13	118,7 KB
R1-1613705.zip	2016/11/19 22:13	343,8 KB
R1-1613706.zip	2016/11/19 22:13	105,9 KB
R1-1613707.zip	2016/11/19 22:13	121,5 KB
R1-1613708.zip	2016/11/19 22:13	111,3 KB
R1-1613709.zip	2016/11/19 22:13	15,3 KB
R1-1613710.zip	2016/11/19 22:13	113,8 KB
R1-1613711.zip	2016/11/19 22:13	107,4 KB
R1-1613712.zip	2016/11/19 22:13	113,2 KB
R1-1613713.zip	2016/11/19 22:13	126,4 KB
R1-1613714.zip	2016/11/19 22:13	44,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613715.zip	2016/11/19 22:13	65,7 KB
R1-1613716.zip	2016/11/19 22:13	27,1 KB
R1-1613717.zip	2016/11/19 22:13	25,2 KB
R1-1613718.zip	2016/11/19 22:13	259,4 KB
R1-1613719.zip	2016/11/19 22:13	107,4 KB
R1-1613720.zip	2016/11/19 22:13	80,7 KB
R1-1613721.zip	2016/11/19 22:13	99,5 KB
R1-1613722.zip	2016/11/19 22:13	48,9 KB
R1-1613723.zip	2016/11/19 22:13	109,6 KB
R1-1613724.zip	2016/11/19 22:13	24 KB
R1-1613725.zip	2016/11/19 22:13	31,6 KB
R1-1613726.zip	2016/11/19 22:13	57,1 KB
R1-1613727.zip	2016/11/19 22:13	50,7 KB
R1-1613728.zip	2016/11/19 22:13	54,3 KB
R1-1613730.zip	2016/11/19 22:13	18,6 KB
R1-1613731.zip	2016/11/19 22:13	32 KB
R1-1613732.zip	2016/11/19 22:13	20,2 KB
R1-1613733.zip	2016/11/19 22:13	32,9 KB
R1-1613734.zip	2016/11/19 22:13	189,9 KB
R1-1613735.zip	2016/11/19 22:12	14,8 KB
R1-1613736.zip	2016/11/19 22:12	16,1 KB
R1-1613737.zip	2016/11/19 22:12	33,3 KB
R1-1613738.zip	2016/11/19 22:12	40,5 KB
R1-1613739.zip	2016/11/19 22:12	238,9 KB
R1-1613740.zip	2016/11/19 22:12	105,5 KB
R1-1613741.zip	2016/11/19 22:12	259,1 KB
R1-1613742.zip	2016/11/19 22:12	34,3 KB
R1-1613743.zip	2016/11/19 22:12	113,3 KB
R1-1613744.zip	2016/11/19 22:12	566 KB
R1-1613745.zip	2016/11/19 22:12	37,6 KB
R1-1613746.zip	2016/11/19 22:12	62,4 KB
R1-1613747.zip	2016/11/19 22:12	37,4 KB
R1-1613748.zip	2016/11/19 22:12	12,6 KB
R1-1613749.zip	2016/11/19 22:12	32,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613750.zip	2016/11/19 22:12	16,4 KB
R1-1613751.zip	2016/11/19 22:12	152,6 KB
R1-1613752.zip	2016/11/19 22:12	133 KB
R1-1613753.zip	2016/11/19 22:12	67,5 KB
R1-1613754.zip	2016/11/19 22:12	34 KB
R1-1613755.zip	2016/11/19 22:12	8,5 KB
R1-1613756.zip	2016/11/19 22:12	29,1 KB
R1-1613757.zip	2016/11/19 22:12	12,4 KB
R1-1613758.zip	2016/11/19 22:12	15,3 KB
R1-1613760.zip	2016/11/19 22:12	13 KB
R1-1613761.zip	2016/11/19 22:12	238,8 KB
R1-1613762.zip	2016/11/19 22:12	31 KB
R1-1613763.zip	2016/11/19 22:12	20,1 KB
R1-1613764.zip	2016/11/19 22:12	32,9 KB
R1-1613765.zip	2016/11/19 22:12	15,7 KB
R1-1613766.zip	2016/11/19 22:12	36 KB
R1-1613767.zip	2016/11/19 22:12	152,6 KB
R1-1613768.zip	2016/11/19 22:12	44,1 KB
R1-1613769.zip	2016/11/19 22:12	43,6 KB
R1-1613770.zip	2016/11/19 22:12	42,9 KB
R1-1613771.zip	2016/11/19 22:12	67,5 KB
R1-1613772.zip	2016/11/19 22:12	49 KB
R1-1613773.zip	2016/11/19 22:12	13,1 KB
R1-1613774.zip	2016/11/19 22:12	34 KB
R1-1613775.zip	2016/11/19 22:12	132,9 KB
R1-1613776.zip	2016/11/19 22:12	29,2 KB
R1-1613777.zip	2016/11/19 22:12	29,2 KB
R1-1613778.zip	2016/11/19 22:12	16,7 KB
R1-1613779.zip	2016/11/19 22:12	46,4 KB
R1-1613780.zip	2016/12/15 8:21	115,3 KB
R1-1613781.zip	2016/11/29 8:41	29,9 KB
R1-1613782.zip	2016/11/19 22:12	49 KB
R1-1613783.zip	2016/11/19 22:12	37,4 KB
R1-1613784.zip	2016/11/29 8:41	54,1 KB

sort by name/desc	sort by date/desc	sort by size/desc
R1-1613785.zip	2016/11/29 8:41	173,8 KB
R1-1613786.zip	2016/11/29 8:41	64,3 KB
R1-1613787.zip	2016/11/29 8:41	54,1 KB
R1-1613788.zip	2016/11/23 11:08	41,8 KB
R1-1613789.zip	2016/11/29 8:41	155,6 KB
R1-1613790.zip	2016/11/29 8:41	117,4 KB
R1-1613791.zip	2016/11/30 9:20	27,3 KB
R1-1613792.zip	2016/11/30 9:20	58,4 KB
R1-1613793.zip	2016/11/30 9:20	21,4 KB
R1-1613794.zip	2016/11/29 9:13	359,4 KB
R1-1613795.zip	2016/11/29 8:58	12,6 KB
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R1-1613801.zip	2016/12/01 8:00	311 KB
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R1-1613805.zip	2016/12/15 9:57	45 KB
R1-1613806.zip	2016/12/16 7:44	28,5 KB
R1-1613807.zip	2016/12/16 7:44	19,1 KB
R1-1613808.zip	2017/01/13 21:24	1285,6 KB
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R1-1613811.zip	2017/01/15 0:55	1863,1 KB
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R1-1613815.zip	2017/01/15 0:55	710,5 KB
R1-1613816.zip	2017/01/25 9:43	14 KB
R1-1613817.zip	2017/01/25 21:11	46,4 KB
R1-1613818.zip	2017/02/08 17:03	53,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-1613819.zip	2017/02/08 17:03	151,2 KB
R1-1613820.zip	2017/02/08 17:13	33,1 KB
TDoc_List_Meeting_RAN1#87.xlsm	2017/02/28 3:11	613,4 KB
TDoc_List_Meeting_RAN1#87.xlsx	2022/01/10 15:29	611,3 KB
TDoc_List_Meeting_RAN1#87.zip	2018/01/10 16:44	1080,6 KB

2653 items.

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3GPP_TSG_RAN_WG1 Archives
November 2016, Week 4

3GPP_TSG_RAN_WG1@LIST.ETSI.ORG

Options: Use Monospaced Font
Show Text Part by Default
Show All Mail Headers

Message: [<< First] [< Prev] [Next >] [Last >>]
Topic: [<< First] [< Prev] [Next >] [Last >>]
Author: [<< First] [< Prev] [Next >] [Last >>]

Subject: [RAN1#87]: Meeting minutes
From: Patrick Merias <[log in to unmask]>
Reply To: Patrick Merias <[log in to unmask]>
Date: Thu, 24 Nov 2016 21:54:42 +0000
Content-Type: multipart/mixed
Parts/Attachments: text/plain (1294 bytes) , text/html (5 kB) ,
Draft_Minutes_report_RAN1#87_v010.zip (1 MB)

Dear all,

Please enclosed is a preliminary version of the report from the biggest little city in the world… ☺
Congratulations→ 75% of the registered delegates have signed in to the meeting – it's a sort of record since the electronic check-in tool is in place.
The last minute debate raised in RAN1#87 regarding the number of contributions was somehow justified…
2613 contributions are uploaded to 3GPP server
Unfortunately, 3GU Tdoc list is not yet fully reflecting the status of all these documents – more effort required here!
Please check the list of agreed CRs listed in the annex B – and the minutes under AI 6.1 and 7.2 – where I noted the different corrections I made further to the checking of all CRs going to plenary…
BR
P

Patrick Merias– Mobile Competence Center Technical Officer
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Phone: +33 (0)4 92 94 42 06 • Mobile: +33 (0)6 07 59 08 47

ATOM RSS1 RSS2

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APPENDIX 26

3GPP TSG RAN WG1 Meeting #88 **R1-17xxxxx**
Athens, Greece, 13th – 17th February 2017

Source:	**MCC Support**
Title:	**Draft Report of 3GPP TSG RAN WG1 #87 v0.1.0 (Reno, USA, 14th – 18th November 2016)**
Document for:	**Comments**



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3GPP TSG RAN WG1 Meeting #88 **R1-17xxxxx**
Athens, Greece, 13th – 17th February 2017

Main facts summary

3GPP TSG WG RAN1 #87 meeting, hosted by the North American Friends of 3GPP, was held at the Peppermill Resort Hotel, Reno, USA.
The meeting started at 9:03 on Monday 14th November and finished at 17:17 on Friday 18th November 2016.
The number of attending delegates, having confirmed their participation through the electronic check-in application, was **491.**
Note that the number of registered was 663.

The schedule of the week was as follows:

- Monday morning: Common session on Agenda items 1, 2, 3, 4 and 6.1 (Maintenance)
- Monday afternoon:
  - Session on NB-IoT (AI 7.2.1) chaired by Matthew Baker.

- Tuesday (NR): chaired by Satoshi Nagata
- Tuesday (LTE session1): chaired by Matthew Baker
  - eMBMS enhancements for LTE (AI 7.3.5), SRS Carrier Based Switching for LTE (AI 7.3.6) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Tuesday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (and possibly other CRs (e.g., LAA, MIMO, eCA), Further Indoor Positioning enhancements for UTRA and LTE (AI 7.3.7), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Tuesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Tuesday (HSPA): Multi-Carrier enhancements for UMTS (AI 6.2) chaired by Carmela Cozzo from Huawei.

- Wednesday (NR): chaired by Satoshi Nagata
- Wednesday (LTE session1): chaired by Matthew Baker
  - Rel-13 CRs Maintenance (AI 7.1), Uplink Capacity Enhancements for LTE (AI 7.3.8), Study on Latency reduction techniques (AI 7.3.10) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Wednesday (LTE session2): chaired by Wanshi Chen
  - Support for V2V services based on LTE sidelink (AI 7.3.2), Study on LTE-based V2X Services (AI 7.3.9) and Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1).
- Wednesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Wednesday (HSPA): DTX/DRX enhancements in CELL_FACH (AI 6.3) chaired by Florent Munier from Ericsson followed by Maintenance.

- Thursday (NR): chaired by Satoshi Nagata
- Thursday (LTE session1): chaired by Matthew Baker
  - Rel-13 CRs Maintenance (AI 7.1), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1), Study on Latency reduction techniques (AI 7.3.10), Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3) and Downlink Multiuser Superposition Transmission for LTE (AI 7.3.4).
- Thursday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (AI 7.1.5), Downlink Multiuser Superposition Transmission for LTE (AI 7.3.4), Study on LTE-based V2X Services (AI 7.3.9), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Thursday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia and session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.

- Friday: Revisions. Continued offline in the morning (eLAA,…).

The list of action points that required RAN1 close follow-up is listed in Annex F (end of document).

The number of contributions for this meeting was xxxx, and those documents were categorized as followed.

Agenda Item	Input Document	Treated Document
All		

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3GPP TSG RAN WG1 Meeting #88 **R1-17xxxxx**
Athens, Greece, 13th – 17th February 2017

Note: The amount of documents includes those discussed during the email discussion session post meeting.

	Contribution is agreed/approved
	Further discussion is required – come-back needed
	Working assumption
	Specific action needed from MCC
	Contribution is for email discussion/approval

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3GPP TSG RAN WG1 Meeting #88 **R1-17xxxxx**
Athens, Greece, 13th – 17th February 2017

1 Opening of the meeting

Mr Satoshi Nagata (RAN1 Chairman) welcomed the participants of the RAN WG1 87 meeting and opened the meeting at 09:03. Mr Gary Jones from T-Mobile USA welcomed the delegates on behalf of the North American Friends of 3GPP, Alcatel Lucent, AT&T, BlackBerry, Cisco, DISH, Ericsson, Intel, InterDigital Communications, Motorola Solutions, NextNav, QUALCOMM, Sprint, T-Mobile USA and Verizon Wireless, and detailed the domestic arrangements for the full week.

1.1 Call for IPR

The attention of the members of this Technical Specification Group was drawn to the fact ***that 3GPP Individual Members have the obligation*** *under the IPR Policies of their respective Organizational Partners to* ***inform their respective*** *Organizational Partners* ***of Essential IPRs they become aware of****.*
The members take note that they are hereby invited:

- *to investigate whether their organization or any other organization owns IPRs which were, or were likely to become Essential in respect of the work of 3GPP.*
- *to notify their respective Organizational Partners of all potential IPRs, e.g., for ETSI, by means of the IPR Information Statement and the Licensing declaration forms (e.g. see the ETSI IPR forms http://webapp.etsi.org/Ipr/).*

1.2 Competition law statement

The Chairman also drew Member's attention to the fact that 3GPP activities are subject to antitrust and competition laws and that compliance with said laws is therefore required of any participant of this WG meeting including the Chairman and Vice Chairmen.
In case of question, please contact your legal counsel.
The present meeting will be conducted with strict impartiality and in the interests of 3GPP.
Furthermore, the Chairman reminded Members that timely submission of work items/contributions in advance of WG meetings is important to allow for full and fair consideration of such matters.

1.3 Network usage conditions

The PCG has laid down the following network usage conditions:

Users shall not use the network to engage in illegal activities. This includes activities such as copyright violation, hacking, espionage or any other activity that may be prohibited by local laws.

Users shall not engage in non-work related activities that consume excessive bandwidth or cause significant degradation of the performance of the network.
Since the **network is a shared resource**, users should exercise some basic etiquette when using the 3GPP network at a meeting. It is understood that high bandwidth applications such as downloading large files or video streaming might be required for business purposes, but delegates should be strongly discouraged in performing these activities for personal use. Downloading a movie or doing something in an interactive environment for personal use essentially wastes bandwidth that others need to make the meeting effective. The meeting chairman should remind end users that the network is a shared resource; the more one user grabs, the less there is for another. Email and its attachments already take up significant bandwidth (certain email programs are not very bandwidth efficient). In case of need the chair can ask the delegates to restrict IT usage to things that are essential for the meeting itself.

1. DON'T place your WiFi device in ad-hoc mode
2. DON'T set up a personal hotspot in the meeting room
3. DO try 802.11a if your WiFi device supports it
4. DON'T manually allocate an IP address
5. DON'T be a bandwidth hog by streaming video, playing online games, or downloading huge files
6. DON'T use packet probing software which clogs the local network (e.g., packet sniffers or port scanners)

2 Approval of Agenda

R1-1611453 **Draft Agenda of RAN1#87 meeting** **RAN1 Chair**
Satoshi Nagata (Chairman) proposed the agenda for the meeting, as well the schedule of the week.
Discussion: Swap of meeting rooms in order to allow Channel Coding session in a larger room that originally planned.
Ericsson's comment→ make sure interested companies in eMTC and VoLTE can join both sessions (Thursday sessions) as there will likely be potential agreements that may have impacts to both WIs.

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Decision: The agenda is approved.

3 Approval of Minutes from previous meeting

R1-1611081 **Final Report of 3GPP TSG RAN1 #86bis v1.0.0 ETSI**

The document was presented by Patrick Mérias (ETSI Mobile Competence Center) and provides the outcomes of last meeting in Portugal.

Discussion: MCC→ recalled a few rather simple working rules:

- when requesting Tdoc numbers during online sessions – keep MCC aware of any changes affecting the Tdoc information (title, agenda item, tdoc type) versus to the one used while requesting for the numbers
- electronic check-in is important for host to plan and prepare good meeting facilitites
- avoid attaching uncompressed and large documents to email(s) when sharing information in offline discussions → to ease the use of email reflectors and avoid traffic issues during 3GPP mega-meeting.

Decision: The document is approved.

4 Incoming Liaison Statements

LAA related

R1-1611553 **Draft LS response to 802.11 regarding LAA Qualcomm Incorporated**

The document (reply to R1-167908) was presented by Srinivas Yerramalli from Qualcomm.

Discussion: Broadcom has sent comments → will be discussed off line with Qualcomm.

Decision: The document is noted. Continue offline discussions until Friday – (Qualcomm)

LS response to IEEE

Thursday

R1-1613531 **Draft LS response to 802.11 regarding LAA Qualcomm Incorporated**

Decision: The document is noted - revisit on Friday.

Friday: Revised draft LS response in R1-1613694 is endorsed and final LS is approved in R1-1613770.

VoLTE

R1-1611449 **LS on Category M1 UE and VoLTE RAN5, Ericsson**

The document was presented by Johan Bergman from Ericsson and informs about RAN5 WA that a conformant Rel-13 Category M1 UE (operating in CE Mode A or CE Mode B) can be capable of supporting IMS including VoLTE service.

Discussion: No action for RAN1.

Decision: The document is noted.

R1-1611089 **Response LS on Category M1 UE and VoLTE RAN2, Ericsson**

The document was presented by Johan Bergman from Ericsson and RAN2 confirms that:

- a conformant Rel-13 Category M1 UE can be capable of supporting IMS including VoLTE service when operating in coverage requiring CE Mode A. When operating in coverage requiring high number of repetitions, VoLTE latency requirements might not be met.
- It is not likely that a Cat M1 UE (that supports optional capability for CE mode B) can support IMS including VoLTE service when operating in coverage requiring CE Mode B. CE mode B has not been designed with delay-sensitive services such as VoLTE in mind.

Discussion: No action for RAN1.

Decision: The document is noted.

NB-IoT related

R1-1611083 **LS on coverage enhancement in SC-PTM for FeMTC and eNB-IoT RAN2, Ericsson**

The document was presented by Yutao Sui from Ericsson and asks RAN WG1 to discuss whether CE levels are defined for SC-PTM and define how physical layer coverage enhancement pointers are mapped to multicast channels, e.g. CE levels similar to PRACH, repetitions similar to unicast etc.

Discussion: Draft liaison was posted on the reflector in early morning – not submitted yet

Decision: The document is noted. Continue offline discussion w.r.t the reply LS until Wednesday – (Ericsson).

See AI 6.2.9.2

R1-1611084 **LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier RAN2, Ericsson**

The document was presented by Yutao Sui from Ericsson and asks RAN1 to take the non-anchor paging agreements into account and confirm the understanding regarding the PDCCH order, namely:

> For random access triggered by PDCCH order, RAN2 assumes that carrier, preamble/subcarrier index and the NPRACH repetition level can be explicitly indicated in the DCI format.

Decision: The document is noted. Continue offline discussion w.r.t the reply LS until Wednesday – (Ericsson)

See AI 6.2.9.3

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LAA related: PHR for two-stage scheduling

R1-1611085 LS on supporting PHR for two-stage scheduling RAN2, Huawei
The document was presented by Xia Yuan from Huawei. RAN2 concluded that MAC will generate a MAC PDU, including any MAC CEs upon receiving the first UL grant and submit this to lower layers. In this case, if PHR MAC CE is to be included in the MAC PDU, RAN2 agrees that PHY shall provide the PH value before completing MAC PDU construction.
Decision: The document is noted.

R1-1612381 Discussion on PHR transmission on two-step scheduled PUSCH Samsung
The document was presented by … from Samsung and suggests replying to RAN2 that RAN1 does not support PHR transmission on two-step scheduled PUSCH.
Decision: The document is noted.

R1-1612821 Discussion on PHR for two-stage scheduling Huawei, HiSilicon
The document was presented by Xia Yuan from Huawei and considers how to calculate PHR for 2-stage scheduling:

Observation 1: for legacy system, the subframe for calculation of PHR is the scheduled subframe.
Observation 2: for two-stage scheduling, if the subframe for calculation of PHR is based on a reference subframe, more accurate PHR information can be provided to eNB.
Proposal 1: For two-stage scheduling, the subframe for calculation of PHR is based on a reference subframe, i.e. 4 ms after the subframe when the first UL grant was received.

Decision: The document is noted.
R1-1612822 Draft LS reply on PHR for two-stage scheduling Huawei, HiSilicon
Continue offline discussion until Friday – (Huawei, Samsung, Qualcomm)
See AI 6.1.7

R1-1611086 LS on capabilities for 2-step scheduling for eLAA RAN2, Ericsson
The document was presented by Havish Koorapaty from Ericsson and informs about RAN2 agreement to have a capability bit for the 2-step scheduling framework.
Decision: The document is noted.

Miscellaneous

R1-1611087 LS on RAN2 agreements for mobility enhancement RAN2, Intel
The document was presented by Seunghee Han from Intel and ask RAN3 to introduce the following solutions (if found to be feasible):

1. For makeBeforeBreak: from RAN2 point of view, it is recommended to introduce X2 signaling for the target eNB to indicate to the source eNB that the UE has successfully completed the handover and as a result the source eNB can stop the data exchange with the UE. RAN3 can make the final decision.
2. Regarding to item 2, it is RAN2 understanding that the make-before-break indication should be included in the RRC container. RAN3 is kindly asked to verify if there is any issue with such approach.

Discussion: No action to RAN1.
Decision: The document is noted.

R1-1611090 Response LS on Measurement gap enhancement RAN2, Ericsson
The document was presented by Asbjorn Grovlen from Ericsoon and RAN2 agrees that UE support for the short gap is a per UE capability (not per band or per band combination). RAN2 asked RAN4 feedback on:

- In a per CC configuration of gaps, is it possible to mix Measurement Gaps (ether legacy 6ms gaps, or short 3(4) ms gaps), and Network Controlled Short Gaps (interruption gaps) on different carriers?

Discussion: No action to RAN1.
Decision: The document is noted.

R1-1611448 Response LS on the Make Before Break solution RAN3, ZTE
The document was presented by RAN1 chair on behalf of ZTE and the following two major options have been selected for further evaluation for data forwarding for handover (similar principles can be applied for DC case accordingly).

- Option 1: The source eNB starts data forwarding when it decides to stop exchanging data with the UE. The timing for starting data forwarding is determined by an implementation dependent method. The source eNB sends legacy SN Status Transfer message to the target eNB.
- Option 2: After sending RRC message triggering the handover procedure, the source eNB can continue transmitting data over the air, and forwarding the data over X2-U towards the target eNB concurrently. RAN3 is still evaluating the impact on legacy SN Status Transfer procedure related to this option 2.

RAN3 will further proceed with evaluation on the option(s) by taking RAN2 feedback into account.
Discussion: No action to RAN1.
Decision: The document is noted.

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R1-1611091 Reply LS on blind detection evaluations RAN4, MediaTek
The document was presented by Peikai Liao from MediaTek and list the following RAN4 conclusions for MUST Case 3

- In DMRS-based TMs,
  - Without sufficient spatial separation of 2 co-scheduled UEs, the performance loss brought by scheduling interference through non-orthogonal DMRS port is significant, even complete interference information is available for interference cancellation.
  - The throughput degradation due to interference existence blind detection is trivial at the cost of additional UE complexity.
  - When R-ML receiver is considered, assistance information for interference modulation order is recommended for better throughput performance as well as reducing the blind detection complexity of UE.
  - When enhanced IRC receiver is considered, information on interference modulation order is not required.
  - RAN4 will further discuss if enhanced IRC or R-ML will be used for minimum performance requirement definition.
  - Summaries of the performance of R-ML and enhanced IRC receiver can be referred in R4-167245 and R4-168049.

Decision: The document is noted.

R1-1611092 LS on SRS switching time reporting RAN4, Huawei
The document was presented by Weimin Xiao from Huawei.

- For switching between carriers/aggregated carriers in the same band for a specific band, only single value is needed to be reported with the candidate values of 0us, 30us, 100us and 200us depending on UE capability.
- For switching between carriers/aggregated carriers in different bands when the switching-to band is not transmitting for a specific band pair, only single value is needed to be reported with the candidate values of 0us, 30us, 100us, 200us, 300us, 500us and 900us depending on UE capability.

Decision: The document is noted.

R1-1611093 LS on SSTD report mapping RAN4, CATT
The document was presented by Fang Chen Cheng from CATT and asks RAN2 to modify the reporting range and report mapping of SFN and subframe timing difference (SSTD) measurement as proposed.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-1611094 LS response on Network Assistance for Network Synchronization in LTE RAN4, Huawei
The document was presented by RAN1 chair on behalf of Huawei.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-1611444 LS on Multi-carrier enhancements for UMTS RAN2, Ericsson
The document was presented by Gerardo Medina from Ericsson and asks RAN4 to verify the following agreements for MC Enhancement

- On the common TTI boundary the legacy formula is applied.
- On non-common TTI boundary, the power allocation for the carrier configured with 2ms TTI is updated accounting for a reserved power associated to the carrier transmitting on a 10ms TTI basis which is updated only at common TTI boundaries.

Discussion: No action to RAN1.
Decision: The document is noted.

R1-1611445 LS on TTI switching for MC enhancements RAN2, Huawei
The document was presented by Carmela Cozzo from Huawei and informs both RAN1 and RAN3 of the following agreements which were made with regard to TTI switching:

- It is RAN2 working assumption that TTI switching cases between two Dual Cell E-DCH combinations can be considered
- The filtered UPH report for TTI switching can be sent on any of the carriers. The scope of the filtered UPH report is primary carrier or secondary carrier or both

Discussion: Will be treated in the UMTS session.
Decision: The document is noted.

R1-1611446 LS to RAN1 on V2V agreements RAN2, LGE
The document was presented by Hanbyul Seo from LGE and informs about V2X sidelink communication agreements made in RAN2#95bis.

- Change name of SL-D-RNTI to SL-V-RNTI.
- The UE makes the decision of whether to keep the resource or not before transmitting the last MAC PDU of a multi-transmission grant. If the UE decides to keep the resource, the reservation field in SA should be set to a non-zero value.

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- Introduce a configurable resource reservation period, other than 100ms. The values are FFS.
- The maximum value of offset of synchronisation resources relative to SFN/DFN 0 (i.e. SL-OffsetIndicator) should be changed to 159. A new Rel-14 IE is introduced in the synchronization configuration.

Discussion: Will be taken into account in V2V session.
Qualcomm → "Introduce a configurable resource reservation period, other than 100ms" need to discussed – common understanding is to stick to what we already have.
Decision: The document is noted.

R1-1611452 **Reply LS on QoS requirements for V2X SA1, Qualcomm**
The document was presented by … from Qualcomm and confirms the assumption of SA2; i.e. a V2X UE shall be able to perform ProSe Direct Communication when it cannot find a suitable cell of the selected PLMN or has received a specific reject response as per clause 4.5.6 of TS 23.303.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-1611447 **LS Response on introducing a new special subframe configuration RAN3, CATT**
The document was presented by Xueming Pan from CATT. RAN3 agrees to transfer the new defined special subframe configuration 10 (from Rel-14 to enable PUSCH transmission in UpPTS) to the neighbour eNBs via X2 interface.
Decision: The document is noted.

NR related
R1-1611082 **Characteristics of terrestrial IMT systems for frequency sharing / interference analysis in the frequency range** between 24.25 GHz and 86 GHz ITU-R WP 5D
The document was presented by RAN1 chair on behalf of ITU-R and welcomes further input on the parameters, according to the deadline for contributions to the February 2017 WP 5D meeting 26.
Decision: The document is noted.

R1-1611088 **LS on RAN2 agreements for NR DL-based mobility and Cell definition RAN2, Ericsson**
The document was presented by Asbjorn Grovlen from Ericsson and provides RAN2 agreements w.r t DL-based mobility in RRC_CONNECTED mode. As it can be seen from the RAN2 agreements, one of the open issues was how the cell in connected relates to the cell in Idle:

- What are the RAN1 assumptions on whether the signals (e.g. reference and/or synchronisation signals) supporting idle or connected mode operations are transmitted in the same manner or not such as in terms of beamforming configuration (e.g. single beam, multi-beam)?

Decision: The document is noted. Continue offline discussion until Tuesday trying to draw a reply LS to RAN2 – (Samsung, Ericsson)
R1-1612385 [Draft] Reply LS on RAN2 agreements for NR DL-based mobility and cell definition Samsung
R1-1612386 Discussion on NR DL-based mobility and cell definition Samsung
Tuesday
R1-1613348 **Reply LS on RAN2 agreements for NR DL-based mobility and cell definition RAN1**

R1-1611450 **LS on NextGen QoS interim agreements SA2, Intel**
The document was presented by Seunghee Han from Intel and lists topics that SA2 considers to be outside of SA2 scope and within the RAN scope:

1. Any definition of AS-level QoS of DRBs and how uplink and downlink packets (with the associated NAS-level QoS profile and PDU Session information) are mapped to DRBs.
2. When and how DRBs are established for pre-authorised QoS rules.
3. Any multiplexing of QoS Flows (e.g. with the same or different QoS profile(s) belonging to the same or different PDU Session(s)) onto DRBs.

With respect to some of the QoS parameters in TR 23.799 clause 8.2 (e.g. packet delay budget, packet error rate) SA2 would like to point out that SA2 has not yet studied any values.
Discussion: No action for RAN1.
Decision: The document is noted.

R1-1611451 **Requirements for mobile backhaul/fronthaul in a G.fast Deployment Environment ITU-T Study Group 15**
The document was presented by RAN1 chair on behalf of ITU-T and raises questions on the requirements to ensure a backhaul link is useable, including those on latency, jitter and packet loss.
Decision: The document is noted.

R1-1613098 **Reply LS on Requirements for mobile backhaul/fronthaul in a G.fast Deployment Environment Nokia**
The document was presented by Karri Ranta=aho from Nokia.

Discussion: Huawei→ don't thing RAN1 needs to address all topics, would like more time trying to simplify the reply. RAN3 should be one targetted WG.
Decision: The document is noted. Continue offline discussion until Wednesday morning – (Nokia)
Friday:
R1-1613773 **[DRAFT] Reply LS on Requirements for mobile backhaul/fronthaul in a G.fast Deployment Environment Nokia**
Discussion: Shouldn't the reply be reviewed by RAN before forwarding it to ITU-T?
Decision: The document is noted, for email approval until Nov.24th – (Nokia)

The following incoming LS were received during the week:
R1-1613126 **IEEE 802 LMSC response LS on energy detection threshold in future 802.11 technologies IEEE 802** LMSC
The document was presented by RAN1 chair on behalf of IEEE and informs that IEEE 802 LMSC considers there would be significant system harm in modifying the ED threshold used by 802.11ax devices in 5 GHz band when operating at higher transmit power (>+13 dBm), and therefore the ED threshold defined for HE PHY in the 11ax amendment remains the same as that of deployed generations (i.e -62 dBm).
It requests RAN1 to consider the following:
- Indicating its interest in a continued dialog towards a future framework for efficient sharing of the 5 GHz band
- Explicitly defining support for PD-based channel access in a future release of LAA specification.
  - o IEEE 802 notes that support for both preamble detection and preamble transmission (e.g. using CTS-to-Self frames) by LAA devices, together with an alignment of the PD and ED thresholds used by LAA devices with those of 802.11 technologies, would be mutually beneficial for coexistence between deployed 802.11, 802.11ax and LAA devices. This approach would form the basis for the most efficient and fair spectrum sharing between IEEE 802 and 3GPP technologies.

Discussion: Ericsson→ might be more efficient to include any response in the existing reply LS (drafted in R1-1611553)
Decision: The document is noted.

R1-1613316 **Response LS on Use of Exceptional Pool RAN2, LGE**
Decision: The document is treated under AI 6.1.8.
R1-1613317 **LS to RAN1 on resource reservation issues RAN2, LGE**
Decision: The document is treated under AI 6.1.8.
R1-1613446 Reply LS for Voice and Video enhancement for LTE RAN2, Huawei
R1-1613592 LS on RAN2 agreements on FeMBMS RAN2, Ericsson

5 UTRA

R1-1613210 **Report of the UMTS sessions UMTS Session Chairman's Notes (Huawei)**
The document was presented by Carmela Cozzo from Huawei.
Decision: The document is endorsed and content incorporated below.

5.1 Maintenance of UTRA Releases 4 – 13

None.

5.2 Multi-Carrier enhancements for UMTS - WID in RP-161259.

5.2.1 Remaining issues for the introduction of the new configurations

R1-1612761 **Further considerations on power scaling rules for 2ms+10ms configurations Huawei, HiSilicon**
R1-1612985 **Power scaling in DC HSUPA scenarios with mixed TTI configurations Ericsson**

Conclusion: To re-use the legacy power scaling rules for DB-DC/DC HSUPA scenarios with mixed TTI configurations (10ms+2ms TTI & 2ms+10ms TTI).

5.2.2 CRs review

R1-1612760 Introduction of Multi-Carrier Enhancements for UMTS Huawei (Revised in R1-1613207)
R1-1613207 **Introduction of Multi-Carrier Enhancements for UMTS Huawei, HiSilicon, Ericsson, Qualcomm**
Decision: The document is noted and CR0345r1 to 25.212 (rel-13, B) is agreed.

5.2.3 Other

R1-1612984 **On the importance of switching the primary carrier in Multicarrier Enhancements for UMTS Ericsson**
R1-1612762 **Considerations on fast primary carrier switching Huawei, HiSilicon**

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R1-1612983 **L1 parameters within the scope of Multicarrier Enhancements for UMTS Ericsson**

Conclusion: L1 parameters associated with higher order modulation are TTI duration dependent (as in legacy HSUPA 4PAM will not be used in 10ms TTI).

R1-1613208 **LS to RAN2/3 on RAN1 progress on MC enhancements RAN1, Huawei**
Decision: The document is noted and LS is agreed.

5.3 DTX/DRX enhancements in CELL_FACH - WID in RP-160185.

No contributions as RAN1 is done with all the work related to the WI on "DTX/DRX enhancements in CELL_FACH", remaining is being performed in RAN2/3.

6 E-UTRA

6.1 Maintenance of E-UTRA Releases 8 – 14

Only essential corrections.
Note that individual companies can submit draft CRs to this agenda item for Rel-13 items.

R1-1613775 **Chairman's notes of AI 6.1 on CRs Ad-Hoc chair (Qualcomm) (R1-1613713)**
The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is noted.

6.1.1 Maintenance of E-UTRA Release 8 – 12

R1-1611554 **Summary of email discussion on new TBS for DL 256QAM Qualcomm Incorporated**
R1-1612649 **Introduction of new Transport Block Size for DL 256QAM Qualcomm Incorporated**

Conclusion:
- There was no consensus on the usefulness of the new TBS.
  - Exemplary specification changes are shown in R1-1611554
  - The changes are intended for CRS based DL transmissions
  - There are concerns regarding which release the changes should apply
  - There are concerns how the impact on UE category should be specified

6.1.2 Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers

R1-1611555 **Summary of email discussion on eCA issues Qualcomm Incorporated**
R1-1611556 Draft CR on minimum payload size for PUCCH format 4 and PUCCH format 5 Qualcomm Incorporated

Conclusion:
- The 2nd change in R1-1611555 is endorsed
- Further discussion offline regarding the 1st change at least to aim for reaching a common understanding in RAN1, also taking into account the coding scheme if <=22 bits are supported for PUCCH formats 4/5

R1-1611557 **Draft CR on pseudo-random sequence generator for PUCCH format 4 and PUCCH format 5 and sequence group hopping for PUCCH format 4 Qualcomm Incorporated**
Decision: The CR is endorsed. Final CR to be prepared as CR0321 to 36.211 (Rel-13, F), agreed in R1-1613643.
Shadow CR is agreed as CR0322 to 36.211 (Rel-14, A) in /R1-1613644

R1-1612203 **Correction on EPDCCH candidate configuration Nokia, Alcatel-Lucent Shanghai Bell, LG Electronics**
Decision: The CR is endorsed. Final CR to be prepared as CR0808 to 36.213 (Rel-13, F), agreed in R1-1613338.

6.1.3 Maintenance of Release 13 licensed-assisted access to unlicensed spectrum

R1-1611558 **Draft Rel-13 CR on MCOT limits on carriers on which eNB performs Type B LBT Qualcomm Incorporated**
Decision: The CR is agreed as CR0800 to 36.213 (Rel-13, F) in R1-1613101.

R1-1611729 **Correction on DL CWS adjustment for LAA LG Electronics**
R1-1613117 **Correction on DL CWS adjustment for LAA LG Electronics**
R1-1613125 **Correction on DL CWS adjustment for LAA LG Electronics**
Decision: The CR is agreed as CR0801 to 36.213 (Rel-13, F) in R1-1613128 .
R1-1613149 **Correction on DL CWS adjustment for LAA LG Electronics, Intel**
Decision: The shadow CR is endorsed. Final CR to be prepared as CR0804 to 36.213 (Rel-14, A), agreed in R1-1613181.

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6.1.4 Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE

R1-1611917 **Correction on NZP CSI-RS aggregation for Class A** **Intel Corporation, LG Electronics, Samsung**
Decision: CR0309 to 36.211 (Rel-14, A) is agreed.
R1-1612012 **Correction on NZP CSI-RS aggregation for Class A** **Intel Corporation, LG Electronics, Samsung**
Decision: CR0296r1 to 36.211 (Rel-13, F) is agreed, and supersedes the previous version agreed in R1-1610451 (RAN1#86bis).

6.1.5 Maintenance of Release 13 further LTE physical layer enhancements for MTC

R1-1611559 **DCI for SPS** **Qualcomm Incorporated**
Continue discussion offline – Alberto (Qualcomm)
Decision: Agreed as CR0817 to 36.213 (Rel-13, F) in R1-1613252 and shadow CR0818 to 36.213 (Rel-14, A) in R1-1613253.

R1-1613070 **Clarification on i_0 value** **Qualcomm Incorporated**
The second change is for further discussion offline, while the other 3 are endorsed. Alberto (Qualcomm)
Decision: Agreed as CR0301r2 to 36.211 (Rel-13, F) in R1-1613148 and shadow CR0302r1 to 36.211 (Rel-14, A) in R1-1613251. Note both CRs supersede the versions agreed in RAN1#86bis in R1-1610911/R1-1610912.

R1-1611561 **Number of MPDCCH-PRB-sets** **Qualcomm Incorporated**
Continue discussion offline – Alberto (Qualcomm)
Further revised in R1-1613388
Decision: Agreed as CR0819 to 36.213 (Rel-13, F) in R1-1613254 and shadow CR0820 to 36.213 (Rel-14, A) in R1-1613255.

R1-1611562 **UL gap applicability for CE mode A** **Qualcomm Incorporated**
Conclusion:
- The change in R1-1611562 is endorsed (summary of change, Mode A to Mode B). Final CR to be prepared as CR0319 to 36.211 (Rel-13, F), agreed in R1-1613146. Shadow CR in R1-1613147 agreed CR0320r1 to 36.211 (Rel-14, A), agreed in R1-1613256

MCC to correct revision of agreed shadow CR to rev 1

R1-1612812 **PDSCH transmission on special subframe for eMTC** **Nokia, Alcatel-Lucent Shanghai Bell**
Conclusion:
- The change in R1-1612812 is endorsed in principle. Further discussion offline which section to have the change. Final CR to be prepared as CR0812 to 36.213 (Rel-13, F), agreed in R1-1613559. Shadow CR agreed as CR0814 to 36.213 (Rel-14, A), in R1-1613258

R1-1612833 **Draft CR on RV Cycling for PUSCH and PDSCH** **Huawei, HiSilicon**
Conclusion:
- The change in R1-1612833 regarding PDSCH is endorsed. Final CR to be prepared as CR0806 to 36.213 (Rel-13, F), in R1-1613198. Shadow CR agreed as CR0807 to 36.213 (Rel-14, A), agreed in R1-1613199

R1-1613024 **SRS transmission and UL retuning for BL/CE UE** **Ericsson**
Conclusion:
- For the issue raised in R1-1613024, it is understood in RAN1 that PUSCH rate matches around the last SRS symbol, but still mapped to the 2nd last symbol (which got punctured)
  - No CR is necessary

R1-1613025 **Starting PRACH CE level selection for BL/CE UE** **Ericsson**
Continue discussion offline – Johan (Ericsson)
Decision: No further consideration needed in RAN1.

R1-1612359 **Mapping of MPDCCH and PDSCH** **Sequans Communications**
Late submission
Continue discussion offline
Decision: Agreed as CR0314r1 to 36.211 (Rel-13, F) in R1-1613137 and shadow CR0327 to 36.211 (Rel-14, A) in R1-1613257.
MCC: To correct typo in the release field of cover sheet.

6.1.6 Maintenance of Release 13 NB-IoT

R1-1611564 **Clarification on vShift value for CRS** **Qualcomm Incorporated**
Decision: Agreed as CR0323 to 36.211 (Rel-13, F) in R1-1613261 and shadow CR0324 to 36.211 (Rel-14, A) in R1-1613762 with space moved from beginning of line to middle of "cell-specificreference"

R1-1613051 **Correction on narrowband physical-layer cell identities definition in 36.211** **Ericsson** (Revision of R1-1613003)

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Decision: CR is superseded by R1-1613261.
R1-1613052 Correction on narrowband physical-layer cell identities definition in 36.211 Ericsson (Revision of R1-1613004)

R1-1612994 Correction on NPDSCH Mapping to resource elements in 36.211 Ericsson
R1-1612995 Correction on NPDSCH Mapping to resource elements in 36.211 Ericsson
Continue discussion offline (Qualcomm & Ericsson)
- The CR in R1-1612994 is endorsed

Decision: Agreed as CR0315r1 to 36.211 (Rel-13, F) in R1-1613202 and shadow CR0316r1 to 36.211 (Rel-14, A) in R1-1613203

R1-1611726 Baseband signal generation for in-band samePCI non-anchor NEC
Continue discussion offline (Sasaki, NEC)
R1-1613715 Offline discussion summary on NB-IoT baseband signal generation NEC
R1-1613565 Correction to OFDM baseband signal generation of NB-IoT NEC
Further revised in:
R1-1613714 Correction to OFDM baseband signal generation of NB-IoT NEC, NTT DOCOMO, Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, Ericsson
Decision: The CR is endorsed. Final CR to be prepared and agreed as CR0325 to 36.211 in R1-1613768
R1-1613566 Correction to OFDM baseband signal generation of NB-IoT NEC, NTT DOCOMO, Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, Ericsson
Decision: The CR is endorsed. Final CR to be prepared and agreed as CR0326 to 36.211 in R1-1613769

R1-1612829 Corrections on the description of carrier for NB-IoT in TS 36.213 Huawei, HiSilicon
Decision: CR0789 to 36.213 (Rel-13, F) is agreed.
R1-1612830 Corrections on the description of carrier for NB-IoT in TS 36.213 Huawei, HiSilicon
Decision: CR0790 to 36.213 (Rel-14, A) is agreed.
R1-1612831 Corrections on the Table 16.6-2: Type 1- NPDCCH common search space candidates for NB-IoT in TS 36.213 Huawei, HiSilicon
R1-1612832 Corrections on the Table 16.6-2: Type 1- NPDCCH common search space candidates for NB-IoT in TS 36.213 Huawei, HiSilicon
Conclusion:
- The CRs in R1-1612831 and R1-1612832 are agreed in principle, change the cover page "Table 16.6-2 and Table 16.6-~~2~~3". Prepare final CR in R1-1613212 and R1-1613213. Final CR is agreed as CR0791r2 to 36.213 (Rel-13, F), in R1-1613259. Shadow CR agreed as CR0792r2 to 36.213 (Rel-14, A), in R1-1613260
  - The previously agreed CR in R1-1610733 (CR 0751) and R1-1610734 (CR 0752) are superseded by those CRs

R1-1612996 Control information inconsistent handling for NB-IoT in 36.213 Ericsson
Decision: CR0796 to 36.213 (Rel-13, F) is agreed.
R1-1612997 Control information inconsistent handling for NB-IoT in 36.213 Ericsson
Decision: CR0797 to 36.213 (Rel-14, A) is agreed.

R1-1613038 Correction on DCI Format N2 in 36.212 Ericsson
R1-1613039 Correction on DCI Format N2 in 36.212 Ericsson (Revision of R1-1612998)
Conclusion:
- The CRs in R1-1613038 and R1-1613039 are agreed in principle. Update the cover page to include more details including adding the clause affected. Final CR to be prepared and agreed as CR0230r1 to 36.212 (Rel-13, F) in R1-1613204. Shadow CR0231r1 to 36.212 (Rel-14, A) is agreed in R1-1613205.

R1-1612981 BCH transport block size in NB-IOT Nokia
Late submission
Continue offline discussion especially considering RAN2's discussion on the same topic
Decision: Nokia intends to provide a CR in RAN2 to capture higher-layer truncation from 40 bits to 34 bits.

R1-1613071 NRSRP and NRSRQ measurement in NB-IoT Ericsson
Late submission
Continue offline discussion
Revised in R1-1613450 **[DRAFT] WF on NB-IoT Rel-13 NRSRP, NRSRQ & RLM measurements Ericsson**

R1-1613756 Correction on NPDCCH and NPDSCH start symbol Huawei, HiSilicon
Also supported by Ericsson

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The CR is endorsed. Final CR to be prepared and agreed as CR0825 to 36.213 (Rel-13, F) in R1-1613776. Shadow CR0826 to 36.213 (Rel-14, A) is agreed in R1-1613777.

6.1.7 Maintenance of Release 14 Enhanced Licensed-Assisted Access to Unlicensed Spectrum

Channel access

R1-1611732 Correction on continuous transmission after the successful LBT LG Electronics
Continue offline discussion until Wednesday
Revised in R1-1613451
Decision: The CR is endorsed. Final CR agreed as CR0810 to 36.213 (Rel-14, F) in R1-1613528

R1-1611918 Correction on the UL Type 1 channel access description Intel Corporation
Decision: CR0786 to 36.213 (Rel-14, F) is agreed.

R1-1612769 Draft CR on Multi-carrier LBT for Uplink Transmission Ericsson
Agreed in R1-1613133 (CR802 to 36.213 (Rel-14, F)) by following update

> C, and if the carrier frequencies of set of carriers C is a subset of one of the sets of carrier frequencies defined in subclause 5.7.4 in [7],

Decision: Further updated to R1-1613510 (CR0802R1) (removing "draft" from the title)

R1-1611584 Draft CR on using 25us LBT for UEs on carriers without eNB Cat 4 LBT Qualcomm Incorporated
Continue offline discussion until Wednesday
Decision: Further revised in R1-1613166 – and agreed as CR0815 to 36.213 (Rel-14, F) in R1-1613482
Further offline discussion can take place as necessary for any further clarification.

R1-1611585 Draft Rel-14 CR on MCOT limits on carriers on which eNB performs Type B LBT Qualcomm Incorporated
Continue offline discussion until Wednesday
Decision: The CR is endorsed. Final CR prepared and agreed as CR0811 to 36.213 (Rel-14, A) in R1-1613506 (corresponding to R1-1613101 Cat-F)

R1-1612835 Discussion on CWS adjustment for UL Multi-carrier Transmission WILUS Inc.
Continue offline discussion until Wednesday
Conclusion:

- The following two proposals for UL CWS adjustment are aligned with RAN1 understanding
  - Proposal 1: For UL multi-carrier transmission, the UE does not adjust CWS on those carrier(s) when the UE has received UL grant(s) with Type 2 channel access signaling for one or more of the multiple carriers.
  - Proposal 2: For UL multi-carrier transmission, only carriers performing Type 1 channel access are considered.
  - No CR is necessary

PUSCH

R1-1611576 Discussion on UL resource allocation for 10MHz eLAA Qualcomm Incorporated
R1-1611577 Draft 212 CR on UL resource allocation for 10MHz eLAA Qualcomm Incorporated
R1-1611578 Draft 213 CR on UL resource allocation for 10MHz eLAA Qualcomm Incorporated
Continue offline discussion until Wednesday
Decision: Agreed as CR0235 to 36.212 (Rel-14, F) in R1-1613484.

Agreements:

- 10MHz LAA SCell uses 5 bits for resource allocation for PUSCH.
- Resource allocation is bitmap based.

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CR to be prepared in R1-1613529
Decision: Agreed as CR0816 to 36.213 (Rel-14, F) in R1-1613483.

R1-1611567 Draft CR on correction to the PUSCH start position reference and relative timing offset in UL DCI for LAA Qualcomm Incorporated
Decision: Agreed as CR0233 to 36.212 (Rel-14, F) in R1-1613134.

SRS

R1-1611582 Dicussion on simultanoeus transmission on the non-LAA and LAA Scells Qualcomm Incorporated
R1-1611583 Draft CR on SRS dropping rules for eLAA Qualcomm Incorporated
Continue offline discussion until Wednesday
Decision: Revisit next meeting

UL grant

R1-1612384 Correction on PDCCH candidate adjustments Samsung
Decision: Agreed in R1-1613136 (CR824 to 36.213) by changing the category to "F"
MCC to correct a typo in CR number – CR0804 should be read as CR0824

R1-1612613 [Draft] Corrections to EPDCCH candidate derivation procedure for eLAA in TS36.213 Sharp
Decision: Agreed as CR0803 to 36.213 (Rel-14, F) in R1-1613135.

R1-1611573 Draft CR on EPDCCH search space for LAA Qualcomm Incorporated
R1-1611730 Correction on EPDCCH candidate configuration LG Electronics
Continue offline discussion until Wednesday
Decision: The CR is endorsed. Final CR to be prepared and agreed as CR0821 to 36.213 (Rel-14, F) in R1-1613766.

R1-1612611 [Draft] Corrections to bit padding of DCI format 1A for eLAA in TS36.212 Sharp
Decision: The CR is endorsed. Prepare final CR, agreed as CR0234 to 36.212 (Rel-14, F) in R1-1613283.

R1-1612612 [Draft] Corrections to bit padding of DCI format 0B for eLAA in TS36.212 Sharp
Continue offline discussion until Wednesday
Decision: The CR is revised in **R1-1613520** and endorsed. Prepare final CR, agreed as CR0236 to 36.212 (Rel-14, F) in R1-1613485.

R1-1611588 Discussion on UE assumptions on the minimum size of ending partial subframe for receiving UL grants Qualcomm Incorporated
R1-1611589 Draft CR on UE assumptions on the minimum size of ending partial subframe for receiving UL grants Qualcomm Incorporated
Continue offline discussion until Wednesday
Decision: Revisit next meeting

R1-1612290 UL Grant Conflict Handling Panasonic
Continue offline discussion until Wednesday
Related CR is provided in:
R1-1613606 CR on the UE assumption on multiple UL grant indicating a same subframe Intel Corporation, Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm, Samsung, Ericsson, LG Electronics, Huawei, HiSilicon
Decision: CR is agreed as CR0813 to 36.213 (Rel-14, F) in R1-1613486
MCC to remove "draft" from the title

R1-1612291 Maximum Usability of Two-Stage Grants Panasonic
Continue offline discussion until Wednesday
Decision: Continue offline discussion on the remaining aspects until RAN1#88

R1-1612292 CR on trigger monitoring timeline for triggered grants in eLAA Panasonic
R1-1612294 CR on validation for triggered grants in eLAA Panasonic

R1-1613443 CR on trigger monitoring timeline for triggered grants in eLAA Panasonic
Decision: The CR is endorsed. Final CR is agreed as CR0779r1 to 36.213 (Rel-14, F) in R1-1613509**.** It supersedes CR agreed in RAN1#86bis - R1-1611025.

CSI

R1-1611565 Discussion on aperiodic CSI triggering for triggered UL grants in LAA Qualcomm Incorporated
R1-1611566 Draft CR for aperiodic CSI triggering for triggered UL grants in LAA Qualcomm Incorporated
R1-1612293 Virtual CRC for Two-Stage Grants Panasonic
Continue offline discussion until Wednesday

Agreement:

- The reference subframe for trigger based UL grants is the latest valid subframe up to the subframe in which UE received PUSCH trigger A.

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CR to be prepared in R1-1613722 as CR0781r1. ~~Further revised in R1-1613772 by removing the word "and"~~.
Friday: It is noted that R1-1613722 may need some further revision and it is decided to withdraw R1-1613772.
R1-1613782 CR on aperiodic CSI reporting for triggered UL grants in LAA Qualcomm
Decision: CR0781r2 to 36.213 (Rel-14, F) is agreed.

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R1-1611574 **On simultaneous transmission of periodic and aperiodic CSI in eLAA** **Qualcomm Incorporated**
R1-1611575 Draft CR on simultaneous transmission of periodic and aperiodic CSI in eLAA Qualcomm Incorporated
R1-1611586 **Draft CR on UE assumption of LBT success for determining periodic CSI reporting Qualcomm** Incorporated
Conclusion:

- The same Rel-13 CA principle of handling collision of periodic CSI vs. aperiodic CSI across CCs in the same subframe is still applicable to CA involving LAA Scell(s).
  - The condition for determining aperiodic CSI occurrence is that LBT is assumed to be always cleared for the aperiodic CSI

Decision: The CR in R1-1611586 is endorsed. Final CR to be prepared in R1-1613476, revised and agreed in R1-1613530 (removing "draft" in title), as revision 1 of CR0809 to 36.213 (Rel-14, F).

R1-1611731 Correction on aperiodic CSI only transmission for LAA SCell LG Electronics
The CR in is endorsed. Final CR to be prepared and agreed as CR0805 to 36.213 (Rel-14, F) in R1-1613182.

PHR
R1-1611569 **Discussion on PHR reporting for triggered UL grants in LAA** **Qualcomm Incorporated**
R1-1611570 Draft CR on the PHR reporting for triggered UL grants in LAA Qualcomm Incorporated
R1-1612382 Discussion on PH value of two-step scheduling LAA SCell Samsung
R1-1612383 Draft CR on PH value of two-step scheduling LAA SCell Samsung
Continue offline discussion until Wednesday
Update in R1-1613609
R1-1613609 **Draft CR on the PHR reporting for triggered UL grants in LAA** **Qualcomm Incorporated, Samsung, LG Electronics**
Decision: Final version in R1-1613487, revised in R1-1613753, which is endorsed. Final CR to be prepared and agreed as CR0823 to 36.213 (Rel-14, F) in R1-1613771.
LS to RAN2 in:
R1-1613750 **[DRAFT] LS reply on PHR for two-stage scheduling** **Huawei, HiSilicon**
Decision: The document is noted and final LS is approved in R1-1613765.

R1-1611571 **Discussion on computing virtual PHR for LAA Scells** **Qualcomm Incorporated**
R1-1611572 Draft CR on computing virtual PHR for LAA Scells Qualcomm Incorporated
Continue offline discussion until Wednesday

TA
R1-1611579 **Maximum timing advance assumption for LAA and relation to UL grants** **Qualcomm Incorporated**
R1-1611580 Draft CR for maximum timing advance assumptions for LAA and relation to UL grants Qualcomm Incorporated
Continue offline discussion until Wednesday
Decision: Continue discussion by email until RAN1#88 (Qualcomm).

R1-1611581 **N_TA offset for LAA Scells** **Qualcomm Incorporated**
Continue offline discussion until Wednesday

TPC
R1-1612614 **Discussion on a timing issue on UL TPC for LAA Scell** **Sharp**
R1-1611568 **Draft CR for applying TPC commands for UL grants in LAA** **Qualcomm Incorporated**
Continue offline discussion until Wednesday
Revised in R1-1613598, further revised in:
R1-1613751 **Draft CR on applying TPC commands for UL grants in LAA** **Qualcomm Incorporated, Sharp**
Decision: The CR is endorsed. Final CR to be prepared and agreed as CR0822 to 36.213 (Rel-14, F) in R1-1613767.

R1-1613752 WF on TPC accumulated mode for eLAA Sharp, Huawei, HiSilicon, Intel, Kyocera, Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO, Qualcomm, Samsung, WILUS Inc.

6.1.8 Maintenance of Release 14 V2V services based on LTE sidelink

CR submission is only allowed by specification editors.
Note that proponent can submit discussion contribution to this A.I. which contains a possible TP.

UE decoding capability/UE category
R1-1612970 **Discussion on UE decoding capabilities** **Ericsson**

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Proposal 1: The minimum requirements on UE decoding capabilities are sufficient to ensure decoding of all PSCCHs in a subframe and a full bandwidth data transmission in the same subframe:
- *A UE is not expected to try to decode more than 138 RBs in a subframe.*
- *A UE is not expected to try to decode more than 20 PSCCHs in a subframe.*

Proposal 2: Decoding rules are introduced to ensure that transmissions from a given UE are not systematically dropped.

Decision: The document is noted.

R1-1612577 UE Decoding Capabilities for LTE-V2V Communication Intel Corporation

Continue offline discussion until Wednesday – Ericsson, Intel, Qualcomm

R1-1613392 Summary of Offline Discussion on UE Decoding Capabilities for LTE-V2V Communication Intel Corporation

Agreements:

- For UE capability on PSCCH/PSSCH decoding,
  - UE is not expected to attempt to decode more than X PSCCHs in a subframe. UE is able to decode up to X PSCCH in a subframe.
  - UE is expected to attempt to decode at least Y RBs per subframe counting both PSCCH and PSSCH decoding RBs.
  - Two types of UE capability are defined
    - One with (X=10, Y=100), the other with (X=20, Y=136)
- FFS on avoiding systematic dropping of SA candidates
- An additional UE decoding capabilities are defined for LTE V2V sidelink communication
  - Soft buffer size for SL reception is X bits.
    - The value of X is FFS
  - The maximum number of sidelink transport block bits received within a TTI is set to [31704].
  - The maximum number of bits of a single sidelink transport block is [31704].

R1-1611734 Discussion on UE category for PC5 based V2V LG Electronics

Possible agreements:
- The maximum number of sidelink transport block bits received within a TTI is set to 40576
- The maximum number of bits of a single sidelink transport block is 40576

Continue offline discussion until Wednesday

R1-1611132 Discussion on UE decoding capability Huawei, HiSilicon
R1-1611331 Discussion on UE decoding capabilities CATT
R1-1611733 Remaining issues for PC5 based V2V LG Electronics
Proposal 3 only
R1-1613168 WF on V2V Decoding Capabilities Ericsson, Huawei, HiSilicon
R1-1613391 WF on V2V Decoding Capabilities Intel Corporation

DMRS

R1-1611329 Discussion on additional randomization on DMRS for single-subframe transmission case CATT
R1-1612387 Further randomization on DMRS and scrambling code Samsung

Proposal: No specification needed for further DMRS randomization.

Decision: The document is noted. Continue offline discussion until Wednesday

R1-1613112 WF on PSSCH DMRS randomization CATT, LGE

Proposals:
- For the single-subframe transmission, the following Tx UE behavior shall be explicitly specified:
  - Value of frequency resource location field is randomly selected among all the possible code points corresponding to the same subchannel number chosen by the Tx UE.
  - Value of retransmission index field is randomly selected between 0 and 1.

Continue discussion till next meeting
- Companies are encouraged to check whether there is an issue and if so, how to solve it

R1-1611919 PSSCH DMRS generation for sidelink V2V communication Intel Corporation
R1-1611590 Remaining issues for V2V Qualcomm Incorporated
Proposal 3 only
R1-1611733 Remaining issues for PC5 based V2V LG Electronics
Proposal 1 only

Reselection in mode 4

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R1-1611130 **Discussion on reselection counter in sensing** **Huawei, HiSilicon**

Observation 1: Scaling the reselection counter degrades system PRR performance for highway 70km/h scenario.
Observation 2: Scaling the counter would result in a number of UEs that experience large number of consecutive packet losses, which is not desirable for road safety applications.
Proposal 1: Keep the current SL_RESOURCE_RESELECTION_COUNTER and no scaling operation is applied.

Decision: The document is noted.

R1-1611921 **Remaining sensing and resource selection issues for sidelink V2V communication** **Intel Corporation**

Proposal 4: The resource reselection is triggered under the following conditions:

- *The time of resource reservation since the last resource reselection is expired.*
- *UE does not transmit on reserved resources for more than one second.*
  - *Note: the 2nd condition is needed only if UE transmission period can exceed 1000 ms.*

Proposal 5: Update TS 36.212 and TS 36.321 to align in time resource reselection decision and resource release indication.

- *Resource reselection probability is checked in advance when SL_RESOURCE_RESELECTION_COUNTER is equal to 1.*

Decision: The document (Proposal 4, 5 only) is noted.

R1-1612964 **Outstanding issues for mode-4 resource allocation** **Ericsson**

Observation: In current specification, in case of no MAC PDU transmission, the SL reselection counter might never reach 0. This would lead to a deadlock since the UE would not be able to perform again resource reselection.
Proposal: The UE performs resource reselection, i.e., it re-initializes the SL reselection counter and books another set of resources, whenever a configured sidelink grant is left empty.

Decision: The document is noted.

Possible agreement:

- The UE performs resource reselection, i.e., it re-initializes the SL reselection counter and books another set of resources, when the UE skips transmitting on selected subframe in x times

R1-1613316 **Response LS on Use of Exceptional Pool** **RAN2, LGE**
R1-1613317 **LS to RAN1 on resource reservation issues** **RAN2, LGE**
R1-1613472 **WF on sensing operation** **LG Electronics, CATT**

Agreements:

- Proposal on R1-1613317
  - RAN1 agrees that the issues can be solved under the current RAN1 specifications if resource reselection is triggered if any of the following three conditions is met:
    - There is no more resources in the configured sidelink grant and there is new MAC PDU to be transmitted.
    - UE does not transmit on consecutive transmission opportunities ~~reserved resources~~ for one second.
    - UE skips N consecutive transmission opportunities where N is (pre)configured from [1, 2, 3, 4, 5, 6, 7, 8, 9] and it is (pre)configured if this condition is used.

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Prepare a draft LS in:

R1-1613614 **[DRAFT] Response LS on resource reservation issues** **LG Electronics**

Decision: The document is noted and final LS is approved in R1-1613778.

R1-1611590 Remaining issues for V2V Qualcomm Incorporated
Proposal 2 only
R1-1611733 Remaining issues for PC5 based V2V LG Electronics
Proposal 2 only
R1-1613167 WF on Reselection counter Ericsson, Huawei, HiSilicon

20% rule

R1-1612815 **Discussion on size of resource candidate set in V-UE sensing operation** **Huawei, HiSilicon**

Agreement: Keep the portion of candidate resource set as 20% of the total candidate resources in the selection window

R1-1611590 Remaining issues for V2V Qualcomm Incorporated
Proposal 1 only
R1-1611921 Remaining sensing and resource selection issues for sidelink V2V communication Intel Corporation
Proposal 2 only

TDD

R1-1611328 **Discussion of resource selection on TDD shared carrier** **CATT**
R1-1612827 **Correction on DCI format 5A** **Huawei, HiSilicon**

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Agreements:

- When a DCI format 5A is sent on a TDD carrier, a two-bit field is added to indicate which SL subframe is scheduled for the UE
- Continue offline discussion of UE behaviour until Friday

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R1-1611920 Support of sidelink V2V communication in LTE TDD systems Intel Corporation

Others

R1-1611330 Discussion on resource selection for multiple SPS processes case in Mode4 CATT

R1-1611868 Miscellaneous corrections for V2V in 36.212 Huawei
Decision: Agreed as CR0232 to 36.212 (rel-14, F) in R1-1613127

R1-1612013 Correction on symbol used for PSSCH in mode 3 and 4 CATT
Decision: Agreed TP and editor will reflect it

R1-1612388 On resource (re)selection in 36.213 Samsung
R1-1613124 WF on resource reselection Samsung, CATT, Huawei, HiSilicon, LGE, ZTE
Continue offline discussion until Wednesday
The WF in R1-1613124 is agreed.

R1-1612947 Discussion on S-RSSI measurement Beijing Xinwei Telecom Techn.
R1-1613045 Discussion on S-RSSI measurement Beijing Xinwei Telecom Techn.
Continue offline discussion until Wednesday

R1-1612952 Correction on PSSCH resource selection Beijing Xinwei Telecom Techn.
Proposal: Align P_{rsvp} and P_{rsvp_TX} in TS 36.213.
Decision: Agreed the proposal

R1-1612963 On PSSCH decoding performance Ericsson

6.1.9 Other

R1-1612214 Correction on downlink power allocation for SC-PTM TD Tech, Huawei
Decision: CR0787 to 36.213 (Rel-14, A) is agreed.

R1-1612878 New UL/DL UE Category Combination MediaTek, CMCC
Same contribution being disucssed in RAN2.

6.2 LTE Release 14

Friday

Based on the list of agreements provided by the rapporteurs, specs editors will provide updated draft CRs for MUST, SRS, V2V, High speed that include and reflect the agreements and WA from RAN1#87. Due by Tuesday 22nd November and for email approval by Monday 28th November.

Rapporteurs for UL enhancements and eMBMS will provide their list of agreement until Monday 21st November.
Spec editors will provide draft CRs for UL enhancements and eMBMS that include and reflect the agreements and WA from RAN1#87. Due by 9th December and for email approval by Thursday 15th December.

Rapporteurs for V2X, FD-MIMO, FeMTC, NB-IoT enh., eVoLTE will provide their list of agreements until Thursday 15th December.
Specs editors will provide draft CRs for V2X, FD-MIMO, FeMTC, NB-IoT enh., eVoLTE that include and reflect the agreements and WA from RAN1#87. Due by Friday 27th January 2017.
Editors may update the draft CRs for comments received until RAN1#88 (Athens).

6.2.1 LTE-based V2X Services - WID in RP-161894

R1-1613698 Chairman's notes of AI 6.2.1 on LTE-based V2X Services Ad-Hoc chair (LGE)
The document was presented by Hanbyul Seo from LG Electronics.
Discussion:
Decision: The document is endorsed and content incorporated below.

R1-1611869 Introduction of V2X into 36.212 Huawei

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Email approval until 8th Dec on the LS to RAN2/4 capturing all the agreements and working assumptions – Hanbyul (LGE)

Email approval until 8th Dec on the LS to RAN2 including RRC parameters – Hanbyul (LGE)

6.2.1.1 Enhancement to UL and SL SPS

6.2.1.1.1 Remaining details of DCI design

R1-1611191 Remaining issues for SPS DCI design Huawei, HiSilicon
R1-1611332 Remaining details of DCI design CATT
R1-1611591 SPS enhancements for V2X Qualcomm Incorporated
R1-1611735 Remaining details of DCI design for SL and UL SPS LG Electronics
R1-1612100 DCI format of V2X SPS resources ZTE
R1-1612112 Discussion on size alignment between SL SPS DCI and DCI format 0 Panasonic
R1-1612171 Remaining details of DCI design CMCC
R1-1612389 Support of multiple SL/UL SPS configurations Samsung
R1-1612879 On Signalling for SPS Nokia, Alcatel-Lucent Shanghai Bell
R1-1612939 DCI design for SL SPS Ericsson

R1-1613200 WF on DCI design in TDD CATT, LGE, CMCC, Huawei, HiSilicon, Samsung, Xinwei

Agreements:

~~1.~~● If the DCI for SL SPS or dynamic scheduling is transmitted in subframe n and the offset value (in two-bit field) is set to m, the time location of initial transmission is the first subframe included in the resource pool that occurs at or after subframe n+4+m.
  ~~1.~~■ Offset value is one of {0, 1, 2, 3}.
  ~~2.~~■ Applicable to both SL SPS and dynamic scheduling.
  ~~3.~~■ Subframe n can be any of DL subframes or special subframes in TDD Uu carrier.

R1-1613183 WF on remaining details of V2X UL DCI LG Electronics, ZTE, NTT DOCOMO, Samsung, Panasonic

Agreements:

~~2.~~● Confirm the following working assumptions:
  ~~1.~~■ A V2X UL SPS RNTI different from the legacy SPS C-RNTI is defined.

R1-1613184 WF on remaining details of SL DCILG Electronics, Samsung, NTT DOCOMO, Nokia, ASB, CATT, Panasonic
Continue discussion in RAN1#88.

6.2.1.1.2 Others

Including explicit release and implicit release mechanism

R1-1612686 On support of implicit SPS release for sidelink V2X NTT DOCOMO, INC.

R1-1611135 Remaining issues for SPS procedures Huawei, HiSilicon
R1-1611736 Remaining details of UE behavior for SL and UL SPS LG Electronics

6.2.1.2 Resource selection for pedestrian UEs

R1-1613653 WF on P-UE LG Electronics, NTT DOCOMO

Agreements:

~~3.~~● P-UE performing partial sensing or random selection does not transmit SLSS/PSBCH.
~~4.~~● (Pre)configuration instructs whether a P-UE uses partial sensing only, random selection only, or either of the two (FFS whether the selection is made by UE implementation).
  ~~1.~~■ When a P-UE is instructed to use partial sensing only, FFS whether there is any case where the P-UE uses random selection.

6.2.1.2.1 Details of random selection by pedestrian Ues

R1-1612880 Comments on Pool Configuration with Random Selection Nokia, Alcatel-Lucent Shanghai Bell
R1-1611922 Random resource selection by pedestrian UEs for P2V communication Intel Corporation
R1-1612390 Random resource selection for pedestrian UE Samsung
R1-1612960 On random resource selection for V2P Ericsson

R1-1611737 Details of random resource selection for P-UE LG Electronics

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R1-1612101 Details of random selection by pedestrian UEs ZTE
R1-1612615 Details Discussion On P-UE Random Resource Selection Sharp
R1-1612881 On random resource selection for V2P communication Nokia, Alcatel-Lucent Shanghai Bell

R1-1613664 WF on random selection by P-UE LG Electronics, Samsung
Continue discussion in RAN1#88

6.2.1.2.2 Details of resource selection using partial sensing by pedestrian Ues

Including the aspects related to the subframe subset for sensing and the subframe subset for resource selection

R1-1611136 Evaluation results for P-UE partial sensing Huawei, HiSilicon
R1-1611266 Partial sensing for pedestrian UEs Sequans Communications
R1-1612687 Details of resource selection using partial sensing by pedestrian UE NTT DOCOMO, INC.
R1-1611738 Details of partial sensing for P-UE resource selection LG Electronics

R1-1611192 Procedure for P-UE partial sensing Huawei, HiSilicon
R1-1611334 Discussion on P-UE resource selection CATT
R1-1611548 Discussion on detail of partial sensing for pedestrian UE Sony
R1-1611592 Sensing based resource selection for V2P Qualcomm Incorporated
R1-1611923 Partial sensing for P2V communication Intel Corporation
R1-1612102 Details of resource selection using partial sensing by P-UEs ZTE
R1-1612233 Discussion on partial sensing of pedestrian UEs Beijing Xinwei Telecom Techn.
R1-1612391 Partial sensing for pedestrian UE Samsung
R1-1612882 On resource selection based on partial sensing for V2P communication Nokia, Alcatel-Lucent Shanghai Bell

R1-1613279 WF on partial sensing Samsung, Sequans
Also supported by ZTE
Agreements:
~~1.~~● Support of partial sensing is up to UE capability.

R1-1613604 WF on P-UE sensing timeline in partial sensing Huawei, HiSilicon, Sony, Sequans, Samsung, NTT DOCOMO, ITRI, Xinwei, Nokia, ASB, OPPO
Agreement:
~~2.~~● P-UE does not support resource reservation interval shorter than 100 ms.

Agreements:
~~3.~~● When P-UE makes resource selection/reselection decision at TTI m, the possible candidates resources, i.e., Y subframes, are selected in [m+T1, m+T2]
  ~~1.~~■ The minimum allowed value of Y is (pre)configured. Selection of Y subframes is up to P-UE implementation.
~~4.~~● For any candidate resource in subframe n within the set of Y subframes, the P-UE senses at least subframe n-100*k
  ~~1.~~■ The set of k is (pre)configured with each element in the range [1, 10].
~~5.~~● P-UE sensing behavior is FFS when the short period is supported in the TX pool of the P-UE
~~1.~~● FFS when the P-UE starts sensing

R1-1613605 Way Forward on use of resources for P-UE Huawei, HiSilicon, ZTE, OPPO
Continue discussion in RAN1#88

6.2.1.2.3 Others

R1-1611195 Discussion on the necessity of differentiating P-UE and V-UE Huawei, HiSilicon

6.2.1.3 Long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels

6.2.1.3.1 Details of detection options

R1-1611138 Coexistence of 802.11p and V2V services Huawei, HiSilicon
R1-1611924 LTE-V2V coexistence with DSRC technology Intel Corporation
R1-1611739 Discussion on the co-channel coexistence of multiple RATs for V2X LG Electronics
R1-1612932 Detection Sequence in LTE-ITS Sidelink for Coexistence with Other Access Technologies Ericsson

R1-1611593 Co-channel coexistence for DSRC and LTE-V2V Qualcomm Incorporated

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R1-1612103 Coexistence between DSRC and LTE V2V ZTE
R1-1612930 Discussion on Coexistence Between Different Technologies for ITS Services Ericsson

Agreement:
1. Send LS to RAN to inform that RAN1 has identified the following with regard to long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels:
   1. LTE PC5 for V2V can be detected by DSRC devices if DSRC devices are equipped with necessary functionalities.
      1. This detection is possible with the existing physical layer structure of LTE PC5 for V2V.
      2. If further RAN1 specification work is done to allow transmission of some sequence in the last symbol of a subframe, it might further help DSRC receivers in detecting LTE PC5.
   2. RAN can communicate with other organization to determine the need of further RAN1 specification work. RAN1 assumes that the objective is fulfilled without further RAN1 specification work if RAN provides no guidance.

Agreement:
2. Add the following to the above LS:
   1. UEs operating LTE PC5 for V2V can detect DSRC if the UEs are equipped with necessary functionalities.
      1. There is no RAN1 consensus on whether further RAN1 specification work is needed for potential benefit in detecting DSRC.
   2. RAN1 assumes that the objective is fulfilled without further RAN1 specification work if RAN provides no guidance.

R1-1613573 [Draft] LS on long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels [RAN WG1], Ericsson
R1-1613735 [Draft] LS on long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels Ericsson
Agreed in R1-1613574 by changing WI code to "LTE_V2X_Core"

Conclusion:
3. If RAN1 is tasked to specify a solution to further help LTE UEs to detect DSRC, a solution using transmission of some sequence in the last symbol of a subframe should be the starting point.
   1. Qualcomm thinks that the starting point can provide performance gain according to R1-1611593.

6.2.1.4 Congestion control for PC5-based V2X

R1-1611696 Discuss on the UE behaviors when congestion is observed on the UE side Guangdong OPPO Mobile Telecom.

6.2.1.4.1 Remaining details of CBR measurement

R1-1612883 On congestion control for PC5-based V2X Nokia, Alcatel-Lucent Shanghai Bell
R1-1612884 On CBR Measurement Nokia, Alcatel-Lucent Shanghai Bell
R1-1612392 Discussion on congestion control Samsung

R1-1613274 WF on congestion control Huawei, HiSilicon, NEC, OPPO
Agreement:
1. Confirm the WA (100ms in absolute time) of CBR measurement duration:
   1. RAN2 can discuss whether any high layer operation is needed on CBR measurement.
2. Additional measurement for SA pool is supported for SA-data non-adjacent case.
3. A V-UE measures all the resource pools configured as transmission pools.
   1. FFS measurement on exceptional pools.
   2. It is up to RAN2 how to report multiple measurements.
4. Adaptation of the allowed set of values of radio-layer parameters is supported for congestion control.
   1. Both eNB-assisted and UE autonomous transmission parameter (re)configuration are supported
   2. Transmission parameter (re)configuration based on CBR and priority are supported
      1. FFS which transmission parameters are (re)configured.
   3. FFS whether resource reselection is immediately triggered in the event of parameter adaptation

R1-1613642 WF on remaining issues of congestion control Huawei, HiSilicon, LGE, Ericsson, Qualcomm, Samsung, Intel
Agreement:
- An occupancy ratio metric is defined
  - CR is defined as the total number of sub-channels used by the UE for its transmissions divided by the total number of configured sub-channels over a measurement period of [1000]ms

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- Working assumption: The set of radio-layer parameters whose allowed values can be restricted by congestion control are the following:
  - Maximum transmit power (including zero power transmission)
  - Range on number of retransmissions per TB
  - Range of PSSCH RB number (according to subchannel size)
  - Range of MCS
  - Maximum limit on occupancy ratio (CR_limit)
  - FFS whether resource reservation interval needs to be included.
- Lookup table links CBR range with values of the transmission parameters for each PPPP
  - Can be configured or preconfigured. Details up to RAN2.
  - Up to 16 CBR ranges are supported
- FFS details of UE behavior, e.g.,
  - When the UE transmits MAC PDUs with different priorities.
  - When and how the UE drops packet transmissions
  - Any possible impact on sensing and resource selection procedure (e.g., caused by CR_limit)

Email approval until 1st Dec on the working assumption and [1000]ms – Yi (Huawei):
Email discussion until RAN1#88 on the FFS points in the congestion control – Hanbyul (LGE):

Conclusion:

- Note: CR is a metric calculated by the transmitter UE and the parameters in the working assumption are adjusted within the range to meet the CR_limit.

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R1-1613266 WF on CBR signalling LG Electronics, Nokia, ASB, Samsung
Continue discussion in RAN1#88

R1-1613280 WF on CBR measurement of PUE Samsung
R1-1613466 WF on CBR measurement of PUE Samsung, ZTE
Continue discussion in RAN1#88 on the need of congestion control of P-UE

R1-1612111 Discussion on CBR measurement and congestion control behavior Panasonic

R1-1611133 Remaining details of congestion control for V2V Huawei, HiSilicon
R1-1611333 Discussion on CBR measurements CATT
R1-1611594 Congestion control for V2V Qualcomm Incorporated
R1-1611740 Remaining details of congestion measurement LG Electronics
R1-1611925 Sidelink congestion control for V2X services Intel Corporation
R1-1612104 Discussion on congestion control of PC5 carrier ZTE
R1-1612889 Discussion on details of congestion measurement and control Sony
R1-1612933 Details about CBR measurement Ericsson

6.2.1.4.2 Others

Including load balancing across multiple carriers

R1-1611722 Load balancing via dynamic resource sharing for multiple carriers and pools NEC
R1-1611741 Discussion on UE behavior in congestion control LG Electronics
R1-1612198 Considering radio measurements and congestion control for zone based resource management in V2X service ITRI
R1-1612934 Congestion Control Framework for V2V Ericsson
R1-1612966 SLSS/PSBCH and Transmitter Behavior under Congestion Control Restrictions Ericsson

R1-1611742 Discussion on the congestion control for V2X LG Electronics

6.2.1.5 Simultaneous Uu and PC5 operations in different carriers

Considering RAN1#86bis agreements on the UE sidelink transmission capability

R1-1611743 Discussion on power cotrol for simultaneous SL TX and WAN TX in different carriers LG Electronics
R1-1612393 Power allocation for simultaneous UL and SL TX in different carriers Samsung

R1-1611871 Remaining details of cross-carrier scheduling Huawei, HiSilicon

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Working assumption:

1. When UL TX overlaps in time domain with SL TX in different carrier frequency,
    1. The UE may drop UL TX or reduce UL TX power if the PPPP of SL packet is above a (pre)configured PPPP threshold, otherwise the UE may drop SL TX or reduce SL TX power.
1. Note that UL TX power is always prioritized if PPPP threshold is set to the highest value.

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6.2.1.6 Issues in supporting inter-PLMN for Uu and PC5

R1-1611744 Discussion on support of inter-PLMN for Uu and PC5 LG Electronics
R1-1611870 Coexistence of cellular and V2V services Huawei, HiSilicon
R1-1612199 Coordinated and uncoordinated operation in inter-PLMN for V2X scenario ITRI

6.2.1.7 Others

Including remaining details of sidelink synchronization enhancement, multiplexing V2V with other signals/channels, shorter resource reservation period in PC5-based V2V and prioritization of SL TX for V2X over WAN TX

Multiplexing V2V with other signals/channels
R1-1611129 Discussion of V2V support for TDD Huawei, HiSilicon
R1-1611747 Remaining details of multiplexing V2V with other signals/channels LG Electronics
R1-1612107 Allocation of reserved subframe for V2X resources pool ZTE
R1-1612113 Discussion on reserved subframes in V2X Panasonic
R1-1612394 Remaining details on resource pool configuration Samsung
R1-1612578 Discussion on remaining details of reserved V2V subframe configurations Intel Corporation
R1-1612796 Remaining details on handling wrap-around issue in subframe pool configuration for V2V Innovative Technology Lab Co.
R1-1612886 Location of Reserved Subframes Nokia, Alcatel-Lucent Shanghai Bell
R1-1612961 Pool design for V2V Ericsson

Agreement:

2. In case of TDD shared carrier, DL and S(Special) subframes are skipped similar to SLSS subframes
3. The Pstep parameter is adjusted according to UL-DL configuration
    1. Pstep_sharedTDD = Pstep*(UL/(UL+DL+S))

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Agreement:

4. The following V2V subframe bitmap sizes are supported for TDD shared carrier
    1. The bitmap length 100 is replaced by TDD#0: 60; TDD#1: 40; TDD#2: 20, TDD#3: 30, TDD#4: 20, TDD#5: 10, TDD#6: 50

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Sidelink synchronization enhancement
R1-1611137 Remaining details on PSBCH Huawei, HiSilicon
R1-1611190 Remaining details on V2V SLSS/PSBCH transmission Huawei, HiSilicon
R1-1611339 Synchronization enhancements in PC5-based V2V CATT
R1-1611745 Remaining details of V2V synchronization LG Electronics
R1-1612098 Discussion on synchronization subframe CATT
R1-1612106 Remaining details of sidelink synchronization enhancement ZTE
R1-1612200 Remaining enhancement to sidelink synchronization for V2X communications ITRI
R1-1612395 Remaining details on SLSS based synchronization Samsung
R1-1612579 Remaining details of V2V synchronization procedure Intel Corporation
R1-1612689 Remaining details of SLSS based synchronization NTT DOCOMO, INC.
R1-1612885 Remaining details of synchronization enhancements for V2V Nokia, Alcatel-Lucent Shanghai Bell
R1-1612936 Contents of PSBCH for V2X Ericsson
R1-1612951 Distributed Synchronization Procedure for V2X over PC5 Ericsson

R1-1613401 WF on SLSS and PSBCH contents LG Electronics, NTT Docomo, Samsung

Agreement:

1. SLSS/PSBCH transmission and reception is up to UE capability.
2. Preconfiguration for out-coverage UEs can include zero, two, or three sync resources.
    1. No SLSS/PSBCH transmission/reception when zero resource is preconfigured.
    2. Note that this reverts the RAN1#86bis agreement "Rel-12 mechanism is re-used to determine the subframe used for transmissions of SLSS/PSBCH from out-coverage UEs synchronized to SLSS, i.e., two SLSS resources are pre-configured for an out-coverage UE, one is used for SLSS of UE's syncRef and the other is used for SLSS transmission of the UE."
3. Email approval until 1st Dec on the UE behaviour with the following starting points – Yi (Huawei):

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1. Strive for an agreement that is as similar as possible to the starting points.
2. When two resources are included, the following behaviour is used.
    1. The same sync resource is used for UEs directly synchronized with GNSS.
        1. UE directly synchronized to GNSS is not required to monitor PSBCH in the other resource.
    2. A UE that selecting SLSS ID = 0 with coverage indicator = 1 as its sync reference transmits SLSS = 0 with in-coverage indicator = 0.
        1. In-coverage indicator is used to differentiate direct GNSS and in-direct GNSS.
        2. SLSS ID 0 or 168 is used to differentiate 1 hop sync. or more hops for GNSS based synchronization
3. When three resources are included, the behaviour in the following table is used (from R1-1609717).

UE synchronization state:	Resource 1 (“InC resource” or “1st OoC resource”)	Resource 2 (“2nd OoC resource”)	Resource 3 (“GNSS resource”)	Notes
UE is InC, sync to eNB	SS from SS_net, PSBCH			R12/13 solution
UE is InC, sync to GNSS	Reserved SLSS ID, PSBCH			PSBCH used to protect cell-edge UEs. Note that PSBCH should be transmitted on the first resource to avoid interference with OoC GNSS UEs PSBCH.
UE is OoC, synchronized to InC UE with/without GNSS		SS from SS_net PSBCH with InC_flag=0		R12/13 solution
UE is OoC, synchronized to OoC UE with SS_net with/without GNSS	SS from SS_oon PSBCH with InC_flag=0			R12/13 solution
UE is OoC, synchronized to OoC UE with SS_oon and with/without GNSS	SS from SS_oon PSBCH with InC_flag=0 (The sync resource is selected depending on the resource of the incoming sync source)			R12/13 solution
UE is isolated and without GNSS	SS from SS_oon PSBCH with InC_flag=0 (Random sync resource)			R12/13 solution
UE is OoC, synchronized to GNSS	SS from SS_oon PSBCH with InC_flag=0 (Random sync resource)		Reserved SLSS ID, PSBCH	PSBCH only includes DFN-related fields. The third resource is needed to avoid interference to cell-edge UEs.

R1-1613516 WF on remaining issues for V2V synchronization Huawei, HiSilicon, ITRI

Agreements:

1. PSBCH content for Rel-14 V2X is the same as what is in Rel-12 spec.

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Proposal:
2.● When the pre-configured information indicates GNSS (P1) has lower priority, P2 only applies to the UE directly synchronized to eNB.
    1.■ UE directly synchronized to GNSS has the same priority as UE indirectly synchronized to GNSS (P3)
        1.◆ Note that this complements the RAN1#86bis agreement.
    2.■ UE indirectly synchronized to eNB has higher priority than GNSS
Email approval until 1st Dec on this proposal – Seungmin (LGE):

Shorter resource reservation interval
R1-1611131 Remaining details of supporting traffic with shorter periodicityHuawei, HiSilicon
R1-1611134 Remaining details of resource pool logical indexing Huawei, HiSilicon
R1-1611337 Discussion on shorter resource reservation period in PC5-based V2V CATT
R1-1611338 Discussion on reserved subframe CATT
R1-1611595 Remaining issues of shorter resource reservation period support for PC5 based V2V Qualcomm
Incorporated
R1-1611746 Remaining details of supporting shorter periodicity LG Electronics
R1-1611926 Sidelink enhancements to support V2V traffic with smaller periodicity Intel Corporation
R1-1612105 Discussion on smaller periodicity ZTE
R1-1612234 Discussion on shorter resource reservation period for V2X Beijing Xinwei Telecom Techn.
R1-1612396 On supporting smaller periodicity on PC5 based V2V Samsung
R1-1612688 Support of shorter period for V2V communications NTT DOCOMO, INC.
R1-1612969 Support for smaller resource reservation periods in V2X Ericsson

R1-1613201 WF on S-RSSI measurement interval CATT, LGE,NTT DoCoMo, ZTE, Xinwei
Continue discussion in RAN1#88

R1-1613655 WF on Support of Small Transmission Periods for V2V Communication Intel, Qualcomm Inc.
Agreement:
1.■ Confirm that reselection UE scales the number of reservations of other UE within selection window by 1/i when 0<i<1 for the SCI received in the last i*P_step logical subframes in the sensing window. Here i denotes the resource reservation interval in the received SCI.
Continue discussion on the other proposals in RAN1#88

6.2.2 Enhancements on Full-Dimension (FD) MIMO for LTE - WID in RP-160623

R1-1613699 Chairman's Notes of Agenda Item 6.2.2 Enhancements on Full-Dimension (FD) MIMO for LTE Session Chairmen (Nokia, Samsung)
Contents incorporated below
Endorsed

R1-1612763 List of Open Issues for Rel.14 eFD-MIMO Samsung, Nokia, CATT

R1-1612764 List of RRC Parameters for Rel.14 eFD-MIMO Samsung, Nokia, CATT
To be updated in R1-1613496 to reflect agreements in this meeting.
For email approval until 1st Dec, then send LS to RAN2 – Eko, Samsung

6.2.2.1 CSI enhancements

6.2.2.1.1 Advanced CSI

R1-1612660 Smoothly Supportable Numbers of CSI-RS Ports for Advanced CSI Ericsson

Agreement:
- {4,8,12,16,20,24,28,32} CSI-RS ports are supported in advanced CSI
- Aim for a unified structure, with a single common CSI reporting mechanism which is dimensioned or scalable to support all the numbers of ports

Note that this does not imply a single solution for classes A and B

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R1-1613225 WF on number of antenna ports for supporting advanced CSI Huawei, HiSilicon, ASTRI, MediaTek, China Unicom, Deutsche Telekom, Oppo, Xinwei, AT&T, Ericsson, Vodafone, ZTE, ZTE Microelectronics

R1-1611879 Performance evaluation for advanced CSI feedback Huawei, HiSilicon
R1-1611596 Discussion on advanced CSI reporting for eFD-MIMO Qualcomm Incorporated
R1-1612416 Rank 1 linear combination codebook and simulation results Samsung
R1-1613262 Rank 2 linear combination codebook and simulation results Samsung
Revision of R1-1612417
R1-1612661 Advanced CSI Codebook Structure Ericsson
R1-1612662 Advanced CSI Performance and Overhead Ericsson
R1-1612663 Wideband vs. Subband Amplitude Feedback Ericsson
R1-1612665 Unconstrained vs. Constrained Beam Selection Ericsson
R1-1612701 On feedback enhancements to support advanced CSI NTT DOCOMO, INC.

R1-1613275 WF on advanced CSI codebook Ericsson, Samsung, CATT, NTT DOCOMO, Kathrein Werke, Mitsubishi, Verizon, KT Corporation, LG Electronics
Proposed Working Assumption:
- Adopt the proposal in R1-163275
- Reduce the options in both Config 1 and Config 2
  - Support at least PUSCH CSI feedback
  - FFS whether/how PUCCH CSI feedback is supported

R1-1613226 WF on quantised CSI reporting based on orthogonal basis Huawei, HiSilicon, ZTE, ZTE Microelectronics

R1-1613246 WF on advanced CSI codebook Ericsson, Samsung, CATT, NTT DOCOMO, Kathrein Werke, Mitsubishi, Verizon, KT Corporation, LG Electronics

- Alt 1: Config 1 from R1-1613246
  - Support: E///, HW+HiSi (if power scaling is sub-band), ZTE (if number of beams is constrained), QC (if rank 1 is only reported on PUCCH)
  - Object: Sams, ZTE (if number of beams is not constrained), LG
- Alt 1a: Config 1 from R1-1613246 with 2 beams and only QPSK
  - Nok, ASB, E///, QC
- Alt 2: Config 2 from R1-1613246
  - Support: Sams, Intel, LG, AT&T (if both PUSCH & PUCCH), Docomo, Nokia, ASB
  - Object: E///, HW, HiSi
- Alt 2a: Config 2 from R1-1613246 with 2 beams
  - Sams, LG, ZTE (if the 2 beams in W1 are selected by the UE)
- Alt 3: Config 1 + Config 2 from R1-1613246
  - Support: E///, Sams, CATT, LG, Docomo, HW+HiSi (if power scaling is sub-band)
  - Object: Intel, QC
- Alt 4: R1-1613226
  - Support: HW, HiSi, ZTE
  - Object: Sams, LG

R1-1613647 WF on Advanced CSI Codebook Ericsson, Samsung, Huawei, HiSilicon, CATT, NTT DOCOMO, Kathrein Werke, Sprint, Deutsche Telekom, Vodafone, ZTE, ZTE Microelectronics, Xinwei, Mitsubishi, China Unicom, OPPO, Verizon, KT Corporation, ASTRI

Working Assumption:
To be confirmed automatically at RAN1#88 if no significant issues are identified with UE complexity.
Precoders are to be normalized in the equations below.

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- $W_1 = \begin{bmatrix} B & 0 \\ 0 & B \end{bmatrix}$, $B = [p_0 b_{k_1^{(0)},k_2^{(0)}} \cdots p_{L-1} b_{k_1^{(L-1)},k_2^{(L-1)}}]$
  - For rank 1: $W = \begin{bmatrix} \tilde{w}_{0,0} \\ \tilde{w}_{1,1} \end{bmatrix} = W_1 W_2$, and $W_2 = \begin{bmatrix} c_{0,0} \\ c_{1,0} \end{bmatrix}$
  - For rank 2: $W = \begin{bmatrix} \tilde{w}_{0,0} & \tilde{w}_{0,1} \\ \tilde{w}_{1,0} & \tilde{w}_{1,1} \end{bmatrix} = W_1 W_2$, and $W_2 = \begin{bmatrix} c_{0,0} & c_{0,1} \\ c_{1,0} & c_{1,1} \end{bmatrix}$
  - $c_{r,l} = [c_{r,l,0} \cdots c_{r,l,L-1}]^T$, $r = 0,1$, $l = 0,1$
    - $\tilde{w}_{r,l} = \sum_{i=0}^{L-1} b_{k_1^{(i)},k_2^{(i)}} \cdot p_i \cdot c_{r,l,i}$; $r = 0,1$, $l = 0,1$
- $L = 2$ is the number of beams
- b_{k_1,k_2} is a 2D DFT beam from oversampled grid
  - $k_1 = 0,1, \ldots N_1 O_1 - 1$
  - $k_2 = 0,1, \ldots N_2 O_2 - 1$
- $0 \le p_i \le 1$ beam power scaling factor for beam i
- $c_{r,l,i}$ beam combining coefficient for beam i and on polarization r and layer l

W1 Beam selection

- $O_1 = O_2 = 4$
  - $\#N_1 = 1$, $O_1 = 1$
- $2N_1N_2 \in \{4,8,12,16,20,24,28,32\}$
- The leading (stronger) beam index:
  - $k_1^{(0)} = 0,1, \ldots N_1 O_1 - 1$
  - $k_2^{(0)} = 0,1, \ldots N_2 O_2 - 1$
- The second (weaker) beam index:
  - $k_1^{(1)} = k_1^{(0)} + O_1 d_1$
  - $k_2^{(1)} = k_2^{(0)} + O_2 d_2$
    - $d_1 \in \{0, \ldots, \min(N_1, L_1) - 1\}$
    - $d_2 \in \{0, \ldots, \min(N_2, L_2) - 1\}$
    - $(d_1, d_2) \neq (0,0)$
    - Where L_1, L_2 are defined as:
      - If $N_1 \geq N_2$ and $N_1 \neq 1$
        - $L_1 = 4, L_2 = 2$
      - If $N_1 < N_2$ and $N_1 \neq 1$
        - $L_1 = 4, L_2 = 2$
      - If $N_2 = 1$
        - $L_1 = 8, L_2 = 1$

W1 Beam power

- Second beam power quantized with 2 bits
  - $p_0 = 1$, $p_1 \in \{1, \sqrt{0.5}, \sqrt{0.25}, 0\}$

W2

- $c_{0,0,0} = c_{0,1,0} = 1$ always
- $c_{r,l,i} \in \{1, j, -1, -j\}, \forall i, r, l$

- W1 overhead for $N_1 = N_2 = 4$
  - Indicate leading beam: $\lceil \log_2(N_1 N_2 O_1 O_2) \rceil = \lceil \log_2(16 N_1 N_2) \rceil = 8$ bits
  - Indicate second beam: $\lceil \binom{7}{1} \rceil = 3$ bits
  - Relative power of weaker beam: 2 bits

Rank	W1 (bits)	W2 (bits)
1	13	6
2	13	12

- Feedback on PUSCH is supported
- Feedback on PUCCH is supported
  - Details FFS until RAN1#88.

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R1-1612825	Discussion on advanced CSI for Class B	Huawei, HiSilicon
R1-1612666	Support of Advanced CSI for CLASS B	Ericsson
R1-1611928	On beam combining codebook for Class B FD-MIMO	Intel Corporation

R1-1611173	Analysis of orthogonal and non-orthogonal basis	Huawei, HiSilicon
R1-1611174	Design of orthogonal basis in advanced CSI	Huawei, HiSilicon
R1-1611335	Codebook enhancement for advanced CSI	CATT
R1-1611748	Performance evaluation on linear combination based CSI	LG Electronics
R1-1611927	Remaining Details of Advanced CSI Feedback	Intel Corporation
R1-1611426	Further discussion on the design of linear combination codebook	ZTE, ZTE Microelectronics
R1-1612161	Discussion on the performance of CQI reporting based on the NZP CSI-RS	Intel Corporation
R1-1612415	Linear combination codebook design framework	Samsung

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R1-1612664 Rank-2 W2 Codebook for Advanced CSI Reporting Ericsson

6.2.2.1.2 Feedback mechanism enhancement

Including analog feedback, use of PUCCH format 3, and others

R1-1611175 Design of quantized channel weighting in advanced CSI Huawei, HiSilicon
R1-1611427 Feedback mechanism for linear combination based CSI ZTE, ZTE Microelectronics
R1-1611597 Discussion on analog CSI feedback Qualcomm Incorporated
R1-1611749 Discussion on feedback mechanism for eFD-MIMO LG Electronics
R1-1611878 Design of uplink channel for unquantized CSI feedback in advanced CSI Huawei, HiSilicon
R1-1611880 Discussion on uplink channel for quantized channel weighting Huawei, HiSilicon
R1-1612418 Periodic CSI reporting for class A Samsung
R1-1612667 Feedback Mechanisms for Advanced CSI Ericsson

6.2.2.1.3 Non-precoded CSI-RS codebook for 20 – 32 ports

R1-1611283 Design on Non-precoded CSI-RS codebook Nokia, Alcatel-Lucent Shanghai Bell
R1-1611336 Class A codebook enhancement for 20 - 32 ports CATT
R1-1611428 Discussion on Class A codebook for 20-32 ports ZTE, ZTE Microelectronics
R1-1611598 Non-precoded CSI-RS Codebooks for 20-32 ports Qualcomm Incorporated
R1-1611750 Performance evaluation on Class A codebook for eFD-MIMO LG Electronics
R1-1611881 Codebook design for {20,24,28,32} antenna ports Huawei, HiSilicon
R1-1611929 Codebook with beam broadening Intel Corporation
R1-1612193 Discussion on Class A codebook design for up to 32 CSI-RS ports ITRI
R1-1612419 Class A codebook extension and enhancement Samsung
R1-1612668 On the Remaining Details of Non-precoded CSI-RS Codebook Design for 20 to 32 portsEricsson

R1-1613469 WF on non-precoded CSI-RS codebook CATT, Ericsson, Samsung, NTT DOCOMO, CATR, VIVO, OPPO, Xinwei
Revision of R1-1613232
R1-1613233 WF on class A codebook for 20-32 ports Qualcomm, LG Electronics, AT&T, Nokia, Alcatel-Lucent Shanghai Bell, ZTE, ZTE Microelectronics

Agreement:

- The Rel.13 rank 1-8 Class A codebook tables are extended to the agreed port layouts of {20, 24, 28, 32} ports
  - All the four codebook Configs 1-4 of Rel-13 are supported in Rel-14 for 20,24,28 and 32 ports
  - No other codebook Config is introduced for 20, 24, 28 and 32 ports
  - Rank 5-8 codebooks for {20, 24, 28, 32} ports are extended from Rel-13 16-ports codebook

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6.2.2.2 *Open-loop and Semi-open-loop*

R1-1611279 Remaining Details on DMRS-based Semi-open Loop Transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-1611429 Further discussion on enhancements for DMRS-based Semi-Open-Loop Transmission ZTE, ZTE Microelectronics
R1-1611599 Discussion on DMRS based semi-OL Transmission Qualcomm Incorporated
R1-1611751 Discussion on semi-OL for eFD-MIMO LG Electronics
R1-1612420 Simulation results for precoder cycling based on semi-open-loop transmission Samsung

R1-1612162 Remaining Details of Open-loop transmission scheme Intel Corporation

R1-1612816 Design of semi-open-loop transmission schemes Huawei, HiSilicon
R1-1611340 Remaining issues on open-loop and semi-open-loop CATT
R1-1612669 Remaining Details of Semi-Open Loop Transmission Ericsson
R1-1612421 Transmission scheme for semi-open-loop Samsung
R1-1612422 CSI reporting for semi-open-loop Samsung
R1-1612423 DMRS enhancements for semi-open-loop Samsung
R1-1612702 Semi-open-loop MIMO with beamformed CSI-RS NTT DOCOMO, INC.
R1-1612817 Discussion on CSI feedback in semi-open-loop transmission Huawei, HiSilicon

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R1-1613224 WF on CSI feedback for DMRS based semi-open-loop transmission Huawei, HiSilicon, Qualcomm
Proposals:
- For Class B K>1, N CRIs can be reported. N is configured by RRC signalling.
  - Down select from
    - Reported by PUSCH
    - Alternatively reported by PUCCH
  - FFS: N

R1-1613276 WF on CSI feedback for semi-open-loop CATT, Samsung, Nokia, Alcatel-Lucent Shanghai Bell
Proposal:
- For the purpose of CSI feedback, adopt option 2 with pre-determined cycling pattern of beamforming on DMRS
  - For Rel.12 dual-stage codebook (4Tx/8Tx) and Rel.13 class A codebook, per-PRB-cycling within V1, V2, … V_N where

$$W_1 = \begin{bmatrix} B & 0 \\ 0 & B \end{bmatrix}, B = [V_1, \quad V_2 \quad \ldots \quad V_N]$$

  - FFS: Rel.14 class A codebooks (pending design details)

Agreement:
- For the purpose of CSI derivation, the UE assumes option 1 with a single DMRS beam semi-statically configured by codebook subset restriction
  - The single DMRS beam, which is the same for both ports 7&8, is indicated in the i2 field of codebook subset restriction

R1-1613223 WF on transmission mode and signalling for semi-open-loop transmission Huawei, HiSilicon, CATT, Ericsson, LGE, Nokia, ASB, ZTE, ZTE Microelectronics, Samsung
Agreement:
- DMRS based semi-open-loop transmission is introduced within existing transmission mode, i.e. TM9/10
  - Configured by RRC signalling
  - Semi-open-loop PDSCH transmissions are scheduled only using existing DCI formats 2C/2D with a new DMRS port indication table
  - FFS whether semi-open-loop transmission is only with C-RNTI or also with SPS-C-RNTI
- Working assumption: Semi-open-loop is only specified for rank-1/2, unless there is quick consensus on an extension to rank 3/4 in RAN1#88.

R1-1613277 WF on orphan RE CATT, Samsung, Nokia, Alcatel-Lucent Shanghai Bell
FFS until RAN1#88:
- For DMRS-based semi-open-loop,
  - Orphan RE due to 2 ports CSI-RS:
    - Same procedure as in Rel.10
  - Orphan RE due to DMRS : down-select from
    - Option A: 1 orphan RE *per allocated RB*
    - Option B: 1 orphan RE *in the last allocated RB (if number of allocated RB is odd)*
    - Option C: 1 orphan RE *in the last allocated RB of every block of continuous RB allocation with an odd RB number*
    - *Other options not precluded*
  - Location of orphan RE: corresponding to DMRS ports 9/10 of the last DMRS CDM group (see next slide)

6.2.2.3 Non-precoded CSI-RS

R1-1611341 CSI-RS design for CDM-2 and CDM-4 CATT
R1-1612671 On the Need for Additional CDM-4 Patterns for 28 and 32 Ports Ericsson
R1-1612425 Discussions on CDM-4/-8 for non-precoded CSI-RS Samsung
R1-1611342 CSI-RS design for CDM-8CATT
R1-1611713 Proposals for non-precoded CSI-RS with CDM8 NEC
R1-1612670 CDM-8 Design for NZP CSI-RS Ericsson
R1-1611430 Remaining discussion on non-precoded CSI-RS design for eFD-MIMO ZTE, ZTE Microelectronics

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R1-1613179 WF on CSI-RS design for CDM4 LG Electronics, Ericsson, Qualcomm, Intel, Huawei, HiSilicon, CATT

Agreement:

- No additional CDM-4 pattern is supported in Rel-14.

Samsung: note that this means that there is no explicit support for up to 6dB CSI-RS power boosting in the CDM-4 case .

R1-1613229 WF on CDM aggregation for non-precoded CSI-RS Samsung, LGE, Ericsson
Also supported by Docomo, Sony
R1-1613206 WF on CDM aggregation for 32 and 24 CSI-RS ports ZTE, ZTE Microelectronics, Qualcomm, Intel
Also supported by Huawei, CATT, Xinwei

Agreement:

- CDM-8 patterns for {24, 32} ports can be configured by aggregation of CDM-2/4 patterns from different CSI-RS configurations
  - For each CSI-RS resource (i.e. RE configuration), at least one aggregated pattern that supports full power utilization is supported
    - FFS until RAN1#88:
      - Whether more than one aggregated pattern supporting full power utilization per CSI-RS resource (i.e. RE configuration) is supported
      - Whether any patterns which do not support full power utilization are supported (subject to performance benefit being shown)
      - How to specify which aggregated patterns are not supported (if any)
  - Working assumption: No additional RRC parameters will be specified for indication of the CDM-8 patterns
    - Can be revisited if benefit from additional RRC parameter is shown
    - RRC signaling details are FFS
  - A CDM-8 pattern is contained within 1 PRB

R1-1613180 WF on port indexing for CDM4 LG Electronics, Qualcomm
R1-1613389 WF on port indexing for CDM-4 LG Electronics, Qualcomm, Ericsson, CATT, Samsung

Conclusion:

- Companies are encouraged to study the port indexing of CDM-4 considering CSI-RS port sharing including examples R1-1611752 and R1-1611600 until RAN1#88.
  - Other examples are not precluded.

R1-1611176 Density reduction of non-precoded CSI-RS Huawei, HiSilicon
R1-1612424 Remaining details on NP CSI-RS overhead reduction Samsung
R1-1611281 Details on Port Mapping and Density Reduction for Non-precoded CSI-RS Nokia, Alcatel-Lucent Shanghai Bell
R1-1612703 Low-density CSI-RS and port sharing NTT DOCOMO, INC.
R1-1611431 Aperiodic CSI-RS for non-precoded CSI-RS ZTE, ZTE Microelectronics
R1-1611712 Proposals for CSI-RS overhead reduction NEC
R1-1612672 On CSI-RS Port Numbering for CSI-RS Configurations with Reduced Density Ericsson

R1-1611600 Non-precoded CSI-RS design for up to 32 ports Qualcomm Incorporated
R1-1611752 Discussion on remaining details for NP CSI-RS LG Electronics
R1-1612818 Non-precoded CSI-RS port indexing Huawei, HiSilicon

6.2.2.4 Other remaining issues

6.2.2.4.1 Remaining details of aperiodic and frequency domain reduced overhead CSI-RS

List of open issues:

- *Choose X/Y values for activation/release (4 vs. 8)*

R1-1613237 WF on MAC-CE based activation and release mechanism Qualcomm, Xinwei

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Agreement:
- RAN1 recommends X=Y=8ms for activation/release
  - RAN1 to send an LS to RAN2. Chao to prepare a draft LS today, to be endorsed on Friday
- For the activation/release mechanism
  - Simultaneous activation/release of the CSI-RS resources for multiple CSI processes and/or DL CCs can be supported
  - Detailed MAC CE signalling design & payload size & maximum #CC in one MAC CE is up to RAN2
  - Note: maximum 7 bits required for each CSI process (e.g, K=8, N=4, 70 codepoints)

R1-1613697 [Draft] LS on MAC CE based activation/release mechanism for aperiodic and multi-shot CSI-RS Qualcomm
Modify the action to ask RAN2 to confirm the proposal.
Approved with this modification in R1-1613494.

- *EPDCCH vs. AP-CSI-RS collision*

Agreement: Handle EPDCCH vs. AP-CSI-RS collision as eNB implementation issue

R1-1612676 On Collision Issue between EPDCCH and Aperiodic NZP CSI-RS Ericsson

- *Rate matching for AP-CSI*

R1-1611753 Summary of email discussion [86b-11] on PDSCH rate matching LG Electronics
R1-1613243 WF on PDSCH rate matching for supporting aperiodic CSI-RS Samsung, AT&T, CATT, Ericsson, Huawei, HiSilicon, ITL, ITRI, KDDI, LGE, NTT DOCOMO, Qualcomm

Agreement:
- For PDSCH rate matching, 2-bit aperiodic ZP CSI-RS resource signaling field is introduced in DL-related DCIs for all TMs.
  - AP ZP CSIRS resource configuration is defined without subframe_config
  - UE conducts PDSCH rate matching on AP ZP CSIRS at the subframe when the DCI is signaled.
  - AP ZP CSI-RS resource signaling field descriptions are
  - State '0': The 1st RRC-configured AP ZP CSIRS is indicated to be applied.
  - State '1': The 2nd RRC-configured AP ZP CSIRS is indicated to be applied.
  - State '2': The 3rd RRC-configured AP ZP CSIRS is indicated to be applied.
  - State '3': The 4th RRC-configured AP ZP CSIRS is indicated to be applied.
- This applies only to the DCIs used for non-fallback mode

- *QCL for AP-CSI-RS and multi-shot (MS)-CSI-RS*

R1-1613645 WF on remaining issues on QCL for eFD-MIMO LG Electronics, AT&T, CATT, ITL, KT Corporation, Mitsubishi Electric, Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO, Samsung, Xinwei
Proposal:
- For QCL indication on DMRS to multi-shot NZP CSIRS, in TM10, NZP CSI-RS activation/deactivation can be configured with UEs configured with QCL Type B, where
  - NZP CSIRS configured for activation/deactivation can be indicated in PQI for QCL purpose, and follow legacy QCL assumption.
    - UE is not expected to receive PQI indication regarding the multi-shot NZP CSIRS within X(ms) from the NZP CSIRS activation. FFS on X.
    - Note: NZP CSI-RS not configured for activation/deactivation can also be indicated for QCL purpose.
- In TM10, aperiodic NZP CSIRS can be configured with UEs configured with QCL Type B, where
  - UE is not expected that aperiodic NZP CSIRS is indicated in PQI for QCL purpose with DMRS.

R1-1613734 WF on QCL issues for eFD-MIMO LG Electronics, CATT, Ericsson, NTT DOCOMO, Qualcomm, Samsung
Working Assumption:

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Working Assumption will be confirmed in RAN1#88 if benefit is confirmed compared to using periodic NZP CSI-RS and significant problems are not identified.

- In TM10, activation/deactivation of an NZP CSI-RS with *subframe_config* can be configured with UEs configured with QCL Type B, where
  - NZP CSI-RS configured for activation/deactivation can be indicated in PQI for QCL purposes, and follow legacy QCL assumption.
    - UE does not expect to receive PQI indication before receiving Ω (>1) activated NZP CSI-RSs from an NZP CSIRS activation. FFS on Ω – send an LS to RAN4 to ask for their advice – Jonghyun (LG) R1-1613495 – for email approval until Wed 23rd Nov.
    - UE does not expect that a PQI indication is received which indicates a deactivated NZP CSI-RS. FFS the spec impact.
    - Note: NZP CSI-RS not configured for activation/deactivation can also be indicated for QCL purpose.

- *DCI signalling for AP-CSI-RS resource selection*

R1-1612679 Email Summary: [86b-12] Aperiodic CSI-RS selection for eFD-MIMO Ericsson
R1-1613723 WF on aperiodic CSI-RS resource selection Ericsson, Samsung, KT
Revision of R1-1613234

R1-1613728 WF on Aperiodic CSI-RS Resource Selection Huawei, HiSilicon, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, LG Electronics, CATT

- *Support for higher overhead reduction factors (such as 4 or 8) for Class B*

R1-1611930 Remaining details on overhead reduction for Class B FD-MIMO Intel Corporation
R1-1613080 On Additional Density Values for Class B NZP CSI-RS Ericsson
R1-1613235 WF on density reduction of beamformed CSI-RS Huawei

R1-1611753 Summary of email discussion [86b-11] on PDSCH rate matching LG Electronics
R1-1612679 Email Summary: [86b-12] Aperiodic CSI-RS selection for eFD-MIMO Ericsson

R1-1611282 On QCL, Rate Matching and DCI signaling for Aperiodic CSI RS Nokia, Alcatel-Lucent Shanghai Bell
R1-1611343 Remaining issues on aperiodic CSI-RS CATT
R1-1611345 Remaining issues on frequency domain CSI-RS overhead reduction CATT
R1-1611432 Remaining details for aperiodic CSI-RS ZTE, ZTE Microelectronics
R1-1611601 Discussion on CSI relaxation for aperiodic CSI-RS Qualcomm Incorporated
R1-1611602 Remaining details on aperiodic CSI-RS Qualcomm Incorporated
R1-1611754 Remaining details on PDSCH rate matching LG Electronics
R1-1611755 Remaining details on QCL assumptions for eFD-MIMO LG Electronics
R1-1611756 Remaining details on aperiodic beamformed CSI-RS LG Electronics
R1-1611930 Remaining details on overhead reduction for Class B FD-MIMO Intel Corporation
R1-1612426 Remaining Issues on Aperiodic CSI-RS Samsung
R1-1612427 Support of QCL indication for aperiodic and multi-shot CSI-RS Samsung
R1-1612428 Remaining details of aperiodic ZP CSI-RS Samsung
R1-1613080 On Additional Density Values for Class B NZP CSI-RS Ericsson
Revision of R1-1612673
R1-1612674 QCL for Multi-Shot or Aperiodic CSI-RS Ericsson
R1-1612675 Remaining Details on PDSCH Rate Matching Ericsson
R1-1612676 On Collision Issue between EPDCCH and Aperiodic NZP CSI-RS Ericsson
R1-1612677 Remaining Details of Aperiodic CSI-RS Resource Selection Ericsson
R1-1612678 On PHICH Collision Issue Related to Reusing CS Field for Aperiodic CSI-RS Resource Selection Ericsson
R1-1612819 Rate matching for Beamformed CSI-RS Huawei, HiSilicon
R1-1612820 Remaining details on aperiodic and multi-shot CSI-RS Huawei, HiSilicon

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R1-1613236 WF on CSI relaxation for aperiodic CSI-RS Qualcomm

6.2.2.4.2 Remaining details of Hybrid CSI

List of open issues:

- *PUCCH format for 1st eMIMO-Type*

From RAN1#86bis:

Conclusions: More discussion is needed on the proposal below. If the use of PF-3 (e.g. the proposal below) cannot be agreed by RAN1#87 (Reno), the use of PF-3 will be agreed.

- Use PUCCH format 3 (PF-3) for CSI reporting of 1st eMIMO-Type
  - A PF-3 resource is allocated for CSI reporting and/or A/N
- PF resource usage follows legacy-like procedures as follows:
  - For N≥1 CC(s):
    - CSI-only reporting: Use PF-3 resource allocated for CSI
    - A/N-only: If A/N is for Pcell only, use PF-1A/1B resource allocated for A/N. Otherwise use PF-3 resource allocated for A/N
    - CSI and A/N collision: multiplex CSI and A/N using PF-3 resource allocated for A/N
      - For TDD scenario, the DAI is set to be 1 (i.e. PF-1A/B is used only if for PCell and DAI in DCI format is the first DAI with value 1 that the UE detects)

Agreement: PF-2 is used for the 1st eMIMO-Type

- *A-CSI triggering*

R1-1613239 WF on PUSCH CSI feedback LG Electronics, Samsung, Qualcomm, Huawei, HiSilicon, ZTE, ZTE Microelectronics

Agreement:

- For aperiodic CSI reporting for hybrid CSI mechanism 1
  - Either one of CSI for 1st eMIMO-Type (i.e., CSI(1)) and CSI for 2nd eMIMO-Type (i.e., CSI(2)) is triggered for aperiodic CSI reporting.
- The CSI request field of the same size as the legacy CSI request field is used to jointly indicate the triggered eMIMO-Type and CSI process.
  - Reuse the legacy RRC approach for configuration of the trigger

- *Additional scheme(s) for hybrid CSI? 1) Independent PUCCH-PUSCH config, 2) CRI-only reporting for 1st eMIMO-Type*

  R1-1613282 WF on Hybrid CSI Reporting NTT DOCOMO, LG Electronics, Nokia, Alcatel-lucent Shanghai Bell, Qualcomm, Samsung, Xinwei, ZTE, ZTE Microelectronics

Note: Huawei has some concern on the benefit of this mechanism

Agreement:

- Hybrid mechanism 2:
  - Hybrid CSI reporting with one CSI process, support Class B with K>1 CSI-RS resources for the 1st eMIMO-Type and Class B with K=1 CSI-RS resources for the 2nd eMIMO-Type
    - For the 1st eMIMO-Type, CRI is reported
    - For the 2nd eMIMO-Type, CQI/PMI/RI are reported
    - Total number of CSI-RS resources across 2 eMIMO-Types is limited by Rel. 13 UE capability Kmax.
    - Total number of CSI-RS APs across 2 eMIMO-Types is limited by Rel. 13 UE capability Nmax.

R1-1613238 WF on PUCCH CSI feedback LG Electronics, Samsung, ZTE, ZTE Microelectronics, CATT

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- For periodic CSI reporting for hybrid CSIRS mechanism 1
  - Subframe offset of CSI(1) can be configured.
    - The following table is used to configure periodicity and offset of CSI(1):
      - Note that this table is the same as legacy CRI table

$I_{CSI}^{(1)}$	Value of $M_{CSI}^{(1)}$	Value of $N_{OFFSET,CSI}^{(1)}$
$0 \le I_{CSI}^{(1)} \le 160$	1	$-I_{CSI}^{(1)}$
$161 \le I_{CSI}^{(1)} \le 321$	2	$-(I_{CSI}^{(1)}-161)$
$322 \le I_{CSI}^{(1)} \le 482$	4	$-(I_{CSI}^{(1)}-322)$
$483 \le I_{CSI}^{(1)} \le 643$	8	$-(I_{CSI}^{(1)}-483)$
$644 \le I_{CSI}^{(1)} \le 804$	16	$-(I_{CSI}^{(1)}-644)$
$805 \le I_{CSI}^{(1)} \le 965$	32	$-(I_{CSI}^{(1)}-805)$
$966 \le I_{CSI}^{(1)} \le 1023$	Reserved	

- For periodic CSI reporting for hybrid CSIRS mechanism 2, reuse the legacy CRI configuration table for the 1st eMIMO-Type
- For periodic CSI reporting for hybrid CSIRS mechanism 1
  - Collision handling: CSI of 1st eMIMO has the same priority as legacy CRI.

R1-1613178 WF on CSI reporting configuration for hybrid CSI ZTE, ZTE Microelectronics, Intel, NTT DOCOMO
Also supported by: LG, Xinwei

Combination	1	2	3
1st eMIMO-Type	P	A	P and/or A
2nd eMIMO-Type	A	P	P and/or A

Proposal:
- Support combination 1 for hybrid CSI mechanism 1
  - P-CSI is configured for the 1st eMIMO-Type and A-CSI is configured for the 2nd eMIMO-Type
  - Use legacy P-CSI configuration for the 1st eMIMO-Type and A-CSI configuration for the 2nd eMIMO-Type

R1-1611433 Email discussion summary: [86b-15] eMIMO-Types for eFD-MIMO ZTE, ZTE Microelectronics

R1-1611278 Remaining Details of Hybrid CSI Nokia, Alcatel-Lucent Shanghai Bell
R1-1611344 Remaining issues on hybrid CSI CATT
R1-1611434 Remaining details for Hybrid CSI ZTE, ZTE Microelectronics
R1-1611603 Remaining details on hybrid CSI Qualcomm Incorporated
R1-1611757 Remaining details on CSI feedback for Hybrid CSI-RS LG Electronics
R1-1611884 Remaining details on Class A+Class B hybrid CSI-RS Huawei, HiSilicon
R1-1611885 On Class B K>1 and Class B K=1 Hybrid CSI Huawei, HiSilicon
R1-1612429 Remaining Issues of Hybrid CSI Samsung
R1-1612430 Partial port hybrid CSI reporting Samsung
R1-1612592 On CSI reporting for hybrid CSI Intel Corporation
R1-1612680 Aperiodic Hybrid CSI Reporting Ericsson
R1-1612704 CSI Reporting for Hybrid CSI-RS NTT DOCOMO, INC.

6.2.2.4.3 Remaining details of UL DMRS

List of open issues:

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- *Sequence design for L=30*

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R1-1613079 On Length-30 Base Sequence Design for UL DMRS with IFDMA Ericsson
R1-1613241 WF on UL DMRS-sequence design Nokia, Alcatel-Lucent Shanghai Bell, Intel, Qualcomm, CATT, LG, Samsung

Agreement:

- Length-30 base sequences can be obtained from ZC sequences of length-31 by truncating 1st element.

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- *CS/OCC/IFDMA table*

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R1-1613240 WF on UL DMRS Nokia, Alcatel-Lucent Shanghai Bell, Samsung, CATT, LG

Proposal:

- FFS: Additional one DCI bit is introduced to switch between new and legacy table.
- new CS/OCC/IFDMA mapping table is shown as below.

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Cyclic Shift Field in uplink-related DCI format [3]					OCC				IFDMA configuration
000	0	6	3	9	[1 1]	[1 1]	[1 -1]	[1 -1]	odd subcarriers
001	6	0	9	3	[1 -1]	[1 -1]	[1 1]	[1 1]	odd subcarriers
010	3	9	6	0	[1 -1]	[1 -1]	[1 1]	[1 1]	odd subcarriers
011	4	10	7	1	[1 1]	[1 1]	[1 1]	[1 1]	even subcarriers
100	2	8	5	11	[1 1]	[1 1]	[1 1]	[1 1]	even subcarriers
101	8	2	11	5	[1 -1]	[1 -1]	[1 -1]	[1 -1]	even subcarriers
110	10	4	1	7	[1 -1]	[1 -1]	[1 -1]	[1 -1]	even subcarriers
111	9	3	0	6	[1 1]	[1 1]	[1 -1]	[1 -1]	odd subcarriers

R1-1613242 WF on DL control signalling for IFDMA based DMRS Huawei, HiSi, Qualcomm

Proposal:

- The table below Proposal 3 in R1-1608603 is used for new CS/OCC/IFDMA mapping table.
- Additional one bit in DCI is introduced to indicate one of the CSF mapping tables.

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Working assumption:

- Table 1 with an additional one bit in DCI format 0 and 4 to indicate one of the CSF mapping tables in UE specific search space
  - FFS: Whether this is also applicable to SPS-RNTI
  - Note: In common search space the legacy table will be used

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Table 1

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Cyclic Shift Field in uplink-related DCI format [3]					OCC				IFDMA configuration
000	0	6	3	9	[1 1]	[1 1]	[1 -1]	[1 -1]	odd subcarriers
001	6	0	9	3	[1 -1]	[1 -1]	[1 1]	[1 1]	odd subcarriers
010	3	9	6	0	[1 -1]	[1 -1]	[1 1]	[1 1]	odd subcarriers
011	4	10	7	1	[1 1]	[1 1]	[1 1]	[1 1]	even subcarriers
100	2	8	5	11	[1 1]	[1 1]	[1 1]	[1 1]	even subcarriers
101	8	2	11	5	[1 -1]	[1 -1]	[1 -1]	[1 -1]	even subcarriers
110	10	4	1	7	[1 -1]	[1 -1]	[1 -1]	[1 -1]	even subcarriers
111	9	3	0	6	[1 1]	[1 1]	[1 -1]	[1 -1]	odd subcarriers

- *Support for comb hopping*

R1-1612682 On Inter-Slot or Inter-Subframe Comb Hopping for UL DMRS with IFDMA Ericsson
R1-1611280 Remaining Details on UL DMRS Design Nokia, Alcatel-Lucent Shanghai Bell

R1-1613107 WF on comb hopping for UL DMRS Intel, Qualcomm

Proposal:
- Inter-slot and inter-subframe comb hopping is supported.
  - Inter-slot comb hopping is dynamically indicated by the CS/OCC table in UL DCI
    - FFS details of hopping pattern indication
  - Inter-subframe comb hopping can be semi-statically configured by RRC signaling
  - Both inter-slot and inter-subframe comb hopping can be enabled simultaneously

Conclusion:
- There is no consensus in supporting inter-slot hopping in Rel.14.
- Offline discussion on the need for supporting inter-subframe hopping in Rel.14, Continue discussion until RAN1#88.

R1-1611604 Remaining details on uplink DMRS for FD-MIMO Qualcomm Incorporated
R1-1611435 Remaining details for uplink DMRS ZTE, ZTE Microelectronics
R1-1611882 Details on joint CS/OCC/IFDMA indication for uplink DMRS Huawei, HiSilicon
R1-1611758 Remaining details on UL-DMRS enhancement LG Electronics
R1-1611883 Remaining details on uplink DMRSHuawei, HiSilicon
R1-1611931 Remaining Details of UL DMRS Intel Corporation
R1-1612431 Remaining details for UL DMRS enhancement for eFD-MIMO Samsung
R1-1612683 On Joint CS/OCC/IFDMA Mapping Table for Enhanced UL DMRS in eFD-MIMO Ericsson

6.2.3 Downlink Multiuser Superposition Transmission for LTE - *WID in RP-161019*

R1-1613700 Chairman's notes of AI 6.2.3 on Downlink Multiuser Superposition Transmission for LTE Session Chairman (Qualcomm, MediaTek)
Contents incorporated below
Endorsed with following updates

R1-1613617 Draft LS on MUST Higher Layer Signaling MediaTek Inc.
The LS in R1-1613617 is endorsed with the update "An optional power allocation parameter". Final LS approved in R1-1613615.
R1-1611300 Introduction of MUST in 36.212 Huawei, HiSilicon
R1-1612303 Introduction of MUST Ericsson LM

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R1-1613608 Way Forward on text proposal for gray mapping and power allocation Huawei, HiSilicon, SONY

To update the CR regarding spatial layer power allocation and/or Gray mapping for email approval till 11/22 (Mark, Ericsson)

6.2.3.1 *Superposition transmissions*

Related to transmission power ratios for case 3, power allocation for case 1/2 etc.

R1-1611189 On power allocation for MUST Case 1&2 Huawei, HiSilicon
R1-1611606 EPRE computation for MUST case 1 and case 2 Qualcomm Incorporated
R1-1612751 Power Allocation in MUST MediaTek Inc.
R1-1612791 On remaining details of MUST Case 1 and 2 Nokia, Alcatel-Lucent Shanghai Bell

R1-1613455 Way Forward on Power Allocation in MUST Cases 1 and 2 MediaTek, Huawei, HiSilicon, Nokia, ASB, ITRI

Agreements:

~~1.~~ For MUST Case 1, when both MUST-near UE and MUST-far UE have Rank=2, the total Tx power is split equally between two spatial layers

R1-1613222 Way Forward on downlink power allocation for MUST Case 1&2 Huawei, HiSilicon, NTT DOCOMO, LG Electronics, LG Uplus, ZTE, ZTE Microelectronics
R1-1613610 Way Forward on downlink power allocation for MUST Case 1&2 Nokia, Alcatel-Lucent Shanghai Bell
Agreements:

~~1.~~ A new higher layer parameter PA_MUST is introduced for UEs with MUST Case1&2 configuration
  ~~1.~~ If existence of MUST interference is indicated by eNB, the power of MUST near UE's PDSCH is derived from PA_MUST, where PA_MUST corresponds to the total EPRE to the CRS EPRE ratio of the PDSCHs for MUST-far and MUST-near UE in OFDM symbols without CRS. PA_MUST candidates are the same as the legacy PA.
  ~~2.~~ Otherwise, legacy PA is applied to derive the MUST near UE's PDSCH power
~~2.~~ If the new higher layer parameter PA_MUST is not configured for a MUST near UE with MUST Case1&2 configuration, legacy PA replaces PA_MUST

R1-1613513 WF on MUST EVM requirements Nokia, Alcatel-Lucent Shanghai Bell, Ericsson, Qualcomm, Huawei, LG
Agreements:

~~1.~~ Inform RAN4 that
  ~~1.~~ In RAN1 MUST Case 1/2 performance evaluations, the existing 8% Tx EVM has been assumed for macro (c.f. TR 36.859)
~~2.~~ LS to be drafted

R1-1613680 [Draft] LS on EVM assumption in MUST Case1/2 performance evaluations Nokia
Agreed in R1-1613757

R1-1611297 Discussion on Power Allocation for MUST ZTE, ZTE Microelectronics
R1-1611605 Superposition transmission for MUST Qualcomm Incorporated
R1-1612980 Some further details of MUST Gray mapping with spatial precoding Huawei, HiSilicon

6.2.3.2 *Mechanisms for efficient operation*

Related to RRC signaling, DCI, UE assumptions, fallback etc.

R1-1612172 Remaining issues for MUST Case 3 CMCC
R1-1612753 DCI design for MUST MediaTek Inc.
R1-1611759 Discussion on Signaling Assistance Information and remaining issues LG Electronics
R1-1612792 On Signaling for MUST CASE 1/2/3 Nokia, Alcatel-Lucent Shanghai Bell

R1-1613284 Way Forward on Assistance Information for MUST Case 3 ZTE, ZTE Microelectronics, LG electronics

R1-1613457 Way Forward on Assistance Information in MUST Case 3 MediaTek, ZTE, ZTE Microelectronics, Huawei, HiSilicon, ITRI, III

Agreements:

~~1.~~ For MUST Case 3, the assistance information about the interfering UE(s) consists of
  ~~1.~~ Interference existence
  ~~1.~~ Modulation order

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R1-1613456 Way Forward on Antenna Ports of MUST Case 3 MediaTek, ZTE, ZTE Microelectronics, Huawei, HiSilicon, Nokia, ASB, ITRI, CMCC

Agreements:

- In DMRS based transmission scheme of MUST Case 3, the following assumptions are made by UE for co-scheduled DMRS ports
  - Same n_{SCID}
  - Same $n_{ID}^{(n_{SCID})}$
  - Same OCC length

R1-1613459 Way Forward on Number of Spatial Layers in MUST Case 3 MediaTek, Huawei, HiSilicon, ITRI, III

Agreements:

- For MUST Case 3
  - Assistance information for up to k_max interfering spatial layers is provided
    - k_max = 1 or 3, which is configured by RRC-layer signaling
    - Note: k_max doesn't imply the number of interfering spatial layers UE should cancel

R1-1613453 WF on DCI design for Case 1 and 2 LG Electronics, LG Uplus, ZTE, ZTE Microelectronics, Huawei, HiSilicon, NTT DOCOMO

Agreements:

- The following field are additionally defined in the following legacy DCIs
  - For DCI format 1: the 2bit field for MUST interference existence and power ratio.
  - For DCI format 2A: the 2bit field for MUST interference existence and power ratio.
  - For DCI format 2: the 2bit field per layer for MUST interference existence and power ratio.

Table 1. 2bits field for MUST interference existence and power ratio

Value	Description
0	No MUST interference present
1	First power ratio is used
2	Second power ratio is used
3	Third power ratio is used

R1-1613460 Way Forward on Resource Allocation Alignment in MUST Case 3 MediaTek, ZTE, ZTE Microelectronics, Huawei, HiSilicon, ITRI
R1-1613523 WF on signaling for MUST Case 1/2/3 NEC, Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm
R1-1613514 WF on signaling details for MUST Case 1/2 Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm
R1-1613355 WF on signaling details for MUST Case 3 Qualcomm, Nokia, ASB, NEC

Agreements:

- MUST operation with RA alignment of paired UEs is supported for case 3
- For MUST Case 3, the following operation is supported
  - Within the allocated resource, MOD and existence status of interference on an antenna port with signaled assistance information is consistent
  - Single DCI by adding bits of signaled assistance information in the self DCI is supported

R1-1613616 WF on Signaling Design for MUST Case 3 MediaTek, CMCC, III, ITRI, Huawei, HiSilicon
R1-1613285 Way Forward on DCI for MUST Case 3 ZTE, ZTE Microelectronics, Huawei, HiSilicon

Agreements:

- For DCI formats 2C and 2D and *Rel-13-DMRS-table*=1
  - When k_max=1, total 4 bits are added to carry assistance information
    - 2 bits (denoted as B) with the message provided in Table 2 in R1-1613616
    - 2 bits for MOD of the single interfering layer
      - 00: QPSK
      - 01: 16QAM
      - 10: 64QAM

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4. 11: 256QAM

2. When k_max=3, total 6 bits are added to carry assistance information for predefined ordered antenna ports of interfering layers provided in Table 3 in R1-1613616
    1. The assistance information for each port is represented with 4 states
        1. State 1: no interference presence
        2. State 2: interference present with QPSK
        3. State 3: interference present with 16QAM
        4. State 4: interference present with 64QAM or 256QAM
    2. Total 64 states are required when number of layers of desired signal=1 and OCC length=4
    3. Total 16 states are required when number of layers of desired signal=2 and OCC length=4
    4. Total 4 states are required when number of layers of desired signal=1 and OCC length=2

Agreements:

1. For DCI format 2B or *Rel-13-DMRS-table* not configured or *Rel-13-DMRS-table*=0
    1. UE expects k_max = 1 in this case
    2. 2 bits are added to carry assistance information for predefined antenna port of interfering layer provided in Table 1 in R1-1613616
        1. 00: No interference presence
        2. 01: MUST interference is present with QPSK
        3. 10: MUST interference is present with 16QAM
        4. 11: MUST interference is present with 64QAM or 256QAM

R1-1611298	Discussion on Remaining Issues of Signaling for MUST	ZTE, ZTE Microelectronics
R1-1611346	Control signaling for downlink superposition transmission	CATT
R1-1611607	Mechanisms for efficient operation	Qualcomm Incorporated
R1-1611608	MUST UE pairing with existing CQI feedback	Qualcomm Incorporated
R1-1611723	On two-level DCI design for MUST	NEC
R1-1611891	DCI design for MUST Case 1&2	Huawei, HiSilicon
R1-1612705	Discussion on remaining issues and signaling design for DL MUST	NTT DOCOMO, INC.
R1-1612752	Fallback of transmission mode in MUST	MediaTek Inc.
R1-1612754	Discussion on RAN4 reply LS on MUST Case 3	MediaTek Inc.

6.2.4 eMBMS enhancements for LTE - WID in RP-161297

R1-1613701 Chairman's Notes of Agenda Item 6.2.4 eMBMS enhancements for LTE Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

6.2.4.1 Means of using subframes 0, 4, 5, 9 (FS1) and 0, 1, 5, 6 (FS2) for MBSFN

6.2.4.1.1 Synchronization and acquisition of system information for 100% MBSFN subframe carriers

R1-1612823	Design of FDM for carrier with 100% MBSFN subframe allocation	Huawei, HiSilicon
R1-1612826	Evaluation of FDM for carrier with 100% MBSFN subframe allocation	Huawei, HiSilicon
R1-1611609	Initial acquisition and system information for eMBMS for 100% MBSFN subframe allocation	Qualcomm Incorporated
R1-1611493	Performance results for cell acquisition subframe	Nokia, Alcatel-Lucent Shanghai Bell
R1-1611495	Performance comparison of FeMBMS using TDM vs FDM	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612824	Consideration on CAS for carrier with 100% MBSFN subframe allocation	Huawei, HiSilicon
R1-1612992	Synchronization and SI acquisition performance using Cell Acquisition Subframe	Ericsson

Proposal: Confirm the RAN1#86bis Working Assumption on CAS

R1-1613227 Frequency tracking performance for FeMBMS Huawei, HiSilicon

R1-1613599 WF on the proposed conclusion on FDM Intel, Qualcomm, BBC, EBU

R1-1613580 Way Forward on eMBMS enhancements Ericsson, Intel, Qualcomm, EBU, IRT, BBC, DISH

Agreement (supersedes the Working Assumption made in RAN1#86bis):

- For 100% MBSFN subframe allocation FeMBMS carrier transmits a periodic subframe, CAS Cell Acquisition Subframe

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- CAS supports PSS, SSS, CRS, PBCH, PDCCH, PDSCH (SI)
- CAS is always transmitted in subframe #0 with a period of 40ms
- MIB is provided by PBCH in every CAS
- The MIB is transmitted in SFN mod 4 = 0 and can change only in SFN mod 16 = 0 and contains systemFrameNumber equal to the 6 most significant bits of the SFN
- SI can be provided by PDSCH in CAS
- A first SI that may also contain scheduling of further SI can be transmitted in SFN mod 8 = 0 and can change only in SFN mod 16 = 0
- This first SI may be a combination of SIBs, up to RAN2 agreements.
- MCCH change notification and SI modification notification are sent in PDCCH region of the CAS.
- From RAN1 perspective, it is feasible to transmit multiple SI messages in the same subframe by using different RNTIs. RAN2 may consider if this may be used.
- Inform RAN2 that SI modification notification can be conveyed to the UE with Direct Indication signalling.

Note that the following concerns were raised regarding FDM:

- FDM may suffer from channel estimation edge effects due to non-contiguous allocation of PMCH.
- From a UE implementation perspective, parallel FFT processing and the implementation of filter are required.

Agreements:

- For a Rel-14 FeMBMS carrier, the current DCI format 1-C used to indicate MCCH change, is extended to also indicate SI change.
- PBCH in the CAS uses a different scrambling sequence initialization than for legacy PBCH.
- Cross-carrier scheduling is always supported (regardless of presence of unicast control region)
  - PHICH on the scheduling cell is used
- If a UE is configured with self-carrier scheduling, the UE shall assume that unicast control region (including CRS) is always present in all MBSFN subframes.
- For an FeMBMS carrier
  - A UE shall not assume that unicast control region (including CRS) is always present in an MBSFN subframe not assumed to be used for PMCH.
  - A UE can assume that unicast control region (including CRS) is always present in an MBSFN subframe assumed to be used for PMCH with 15kHz numerology.
  - A UE can assume that unicast control region (including CRS) is never present in an MBSFN subframe assumed to be used for PMCH with 1.25kHz numerology.
- Subframes using the new numerology do not need to be allocated in pairs
  - The RS pattern is defined for even and odd subframes independently

R1-1612989 System Information capacity using Cell Acquisition Subframe Ericsson
R1-1611494 SI transmission for FeMBMS Nokia, Alcatel-Lucent Shanghai Bell
R1-1611496 MIB content for FeMBMSNokia, Alcatel-Lucent Shanghai Bell
R1-1611932 Potential enhancements for the reception of Cell Acquisiton Subframes Intel Corporation

R1-1613600 Way forward on the configuration of additional non-MBSFN subframe for SI transmission Intel, Qualcomm, BBC, EBU

Agreements:

- In MIB, two reserved bits are used to signal additional subframes other than CAS which follow CAS immediately for SI transmission. The values are 0, 1, 2, 3.
  - From RAN1 perspective, 1.4MHz does not support a value of 0.
  - Note: The exact signaling for such indication is up to RAN2.
  - Note: It is up to RAN 2 if the first SI for dedicated FeMBMS carrier needs to indicate the presence of a further set of additional non-MBSFN subframes.
- Send LS to RAN 2 about the above agreements - R1-1613490 – JJ, Intel (including all RAN1 agreements made during this meeting)

R1-1613490 [DRAFT] LS regarding RAN1 agreements on FeMBMS Intel
Agreed in R1-1613758 by adding RAN4 in CC part

R1-1613372 Way forward on the CAS enhancements Intel

R1-1613592 LS on RAN2 agreements on FeMBMS

R1-1613593 Draft reply LS to RAN2
Approved in R1-1613492, with R1-1613491 attached.

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R1-1613594 Draft Stage 2 text from RAN1
Endorsed in R1-1613491 with the following modifications:
- Remove "R1" in source to TSG
- Delete one of the two "for"s
- Delete "s" on "1 symbols"

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6.2.4.1.2 L1 signalling aspects

Including support of unicast transmissions in non-MBSFN subframes, definition of unicast control region in MBSFN subframe with extended CP

R1-1612991 Unicast control region for FeMBMS carrier Ericsson
R1-1611890 Unicast control region for carrier with extended MBSFN subframes Huawei, HiSilicon
R1-1611497 FeMBMS Layer 1 signalling considerations Nokia, Alcatel-Lucent Shanghai Bell
R1-1611610 Remaining details of L1 signalling aspects Qualcomm Incorporated
R1-1612990 System Information modification indication for FeMBMS carrier Ericsson
R1-1611933 Potential enhancements for system information transmission on FeMBMS carrier Intel Corporation

6.2.4.2 Remaining details of MBSFN subframes without unicast control region and CRS

R1-1611611 MBSFN subframes without a unicast control region and cell-specific reference signals Qualcomm Incorporated

6.2.4.3 Others

R1-1612011 System simulations: benefit of longer CP for rooftop reception in MBSFNs BBC

6.2.5 SRS Carrier Based Switching for LTE - *WID in RP-160935*

R1-1613418 Chairman's Notes of AI 6.2.5 on SRS Carrier Based Switching for LTE Ad-Hoc Chair (Huawei)
Endorsed with following updates

R1-1613419 LS for SRS Carrier-Based Switching Agreements Huawei
Agreed in R1-1613481

R1-1613619 LS on Updated L1 parameters for SRS Carrier-Based Switching Huawei
R1-1613624 LS on Updated L1 parameters for SRS Carrier-Based Switching RAN1

R1-1611299 Introduction of SRS switching into 36.212 Huawei, HiSilicon
R1-1613056 Introduction of SRS switching to 36.213 Motorola Mobility

R1-1613118 Text Proposal for TS 36.300 for SRS carrier based switching Huawei, HiSilicon
R1-1613629 LS on Text Proposal for TS 36.300 for SRS Carrier-Based Switching RAN1

6.2.5.1 Remaining details of SRS switching and transmission

Including at least details of priority/dropping rules for collision handling

R1-1611128 Remaining details on collision handling Huawei, HiSilicon
R1-1611612 Collision Handling Qualcomm Incorporated
R1-1612432 Priority Dropping Rules for Collision Handling Samsung
R1-1612433 SRS Timing Adjustments Samsung

Agreements:

rity list:

- A/N, SR, RI/PTI/CRI, PRACH > Rel-14 A-SRS > other A-periodic CSI > Rel-14 P-SRS > other CSI > Legacy SRS
- UE is not expected to monitor PDCCH or to receive PDSCH when it collides with SRS switching and transmission time according to the UE's capability
- For a UE for which SRS switching interrupts downlink reception, the UE is not expected to be configured with SRS resource(s) such that SRS switching and transmission time may collide with its PDCCH monitoring in subframe 0 or 5.

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:turing:

- Support puncturing the first or last symbol of PUSCH when it collides with SRS switching and transmission time according to the UE's capability

flexible timing (if configured), for A-SRS triggered by DL grant:

- If colliding with A/N, postpone once to the next configured SRS transmission opportunity

:: Interruption interval on applicable CC due to SRS carrier based switching includes RF retuning time (to and from the switching to CC) and the SRS or RACH preamble transmission time. How to capture in the specifications is up to the editor.

R1-1611613 Triggering and power control of multiple CC Qualcomm Incorporated
R1-1612434 Initial SRS Transmission Power Samsung

Agreements:

he triggering of multiple CC from a same DCI, the ordering of SRS transmission is as follows:

- For Type A DCI, it follows the order in the RRC configuration
- For Type B DCI, it follows the order in the DCI.

resources used for SRS transmissions when multiple SRS are triggered by the same DCI are obtained as follows:

1. The timing of the first SRS transmission (*n=1)* follows legacy timing.
2. For the *n*-th SRS transmissions, determine the first SRS resource after or at the same time as the *(n-1)*-th that does not collide with the *1, …, n-1* SRS transmissions (including retuning times)

Note: The SRS resources are obtained as in legacy LTE (i.e. based on A-SRS configuration).

SRS request, the UE does not expect to receive multiple triggers in the same subframe that results in uplink transmission beyond its UL CA capability including switching time after applying priority rule

For power control:

- TPC for SRS switching-to CC supports both accumulative and absolute mode configured by RRC
  - TPC command bit interpretation: same as for PUSCH
- Revoke the agreement that: "UE is not expected to be configured with both TPC-only group DCI and the joint TPC and A-SRS trigger group DCI"
- In the case that multiple TPC applied in the same subframe for the same CC, the UE expects the values of TPCs are the same.
- Clarification: initialization of f_c(i) after PRACH on the CC follows the existing procedure but with the new power control formula for SRS.

R1-1612767 Finalization of SRS switching SoftBank Corp.

Agreements:

- RAN1 agree that the UE capability signaling indicating the switching time of {0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 5, 5.5, 6, 6.5, 7} OFDM symbol is useful from RAN1 point of view. It is up to RAN2 to define the set of values based on inputs from RAN1 and RAN4.

R1-1613119 Way Forward on SRS carrier based switching Huawei, HiSilicon

Agreement:

- Type A TPC-only group DCI
  - A CC group is configured via RRC signalling for Type A TPC-only group DCI
  - Maximum number of CCs of a group: 8
- Type A TPC group DCI with SRS request field
  - 2 bit SRS request can trigger 1 out 3 CC groups, and the TPC commands are applied to the triggered CC group
  - If no CC group is triggered, the TPC commands are applied to a CC group configured via RRC signalling
    - The number of CCs in this group is no more than the maximal group size among the configured groups associated with trigger
    - Totally 4 groups per DCI; update the RRC parameter list as follows

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- A UE shall ignore UL grant in the random access response, when configured for the PRACH transmission in a TDD CC without PUSCH. It is up to the editor to decide whether this is specification impact.

Agreement in RAN1#86bis:

- Through RRC configuration, allow SRS transmissions on more than 2 UpPTS symbols in the same subframe for the same UE, for A-SRS and P-SRS
  - On the same CC or multiple CCs
- Allow more than one SRS configurations for the subframe, for A-SRS and P-SRS
  - Reuse existing SRS configurations (1 or 2 UpPTS symbols per SRS configuration)

Clarification:

- Up to 6 symbols can be used for SRS on the same CC in one UpPTS according to RRC configuration

l LS to RAN2 and RAN4 with the new agreements.

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6.2.6 Further Indoor Positioning enhancements for UTRA and LTE - *WID in RP-161850*

R1-1613702 Chairman's notes of AI 6.2.6 on Further Indoor Positioning enhancements for UTRA and LTE Qualcomm
Contents incorporated below
Endorsed with following updates

R1-1612302 Introduction of further indoor positioning enhancements Ericsson LM

6.2.6.1 *Remaining issues for OTDOA enhancements*

R1-1611614 Introduction of UE inter-frequency RSTD calibration accuracy reporting Qualcomm Incorporated
R1-1612163 CRS awareness on CRS+PRS for OTDOA Intel Corporation
R1-1612993 On the usage of CRS and PRS for OTDOA Sony

R1-1613586 Way forward on CRS awareness on CRS+PRS for OTDOA Intel Corporation, Acorn Technologies
Also supported by HW, HiSi
Agreements:

1. Optionally signal one bit in LPP per each reference cell and neighbour cell indicating whether or not the MBSFN subframe configuration of reference/neighbour cell is the same as the primary serving cell of the UE

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R1-1613654 [DRAFT] LS on agreement on OTDOA enhancement in RAN1#87 Intel
Agreed in R1-1613755

6.2.6.2 *PRS-based beacons*

R1-1611095 On PRS-based beacon for enhanced indoor positioning Ericsson
R1-1611615 Draft CR 36.211: Additional PRS configuration indices for PRS-based Terrestrial Beacon SystemsQualcomm Incorporated
R1-1611616 Draft CR 36.213: Introduction of PRS-only transmission points for PRS-based Terrestrial Beacon Systems Qualcomm Incorporated
R1-1611617 PRS CP length in MBSFN subframes Qualcomm Incorporated
R1-1611618 Draft CR 36.211: PRS CP length in MBSFN subframes Qualcomm Incorporated

R1-1613620 WF on PRS CP Length in MBSFN Subframes Qualcomm Inc

6.2.6.3 *E-CID enhancements*

R1-1611096 On CSI-RSRP reporting to E-SMLC for enhanced indoor positioning Ericsson
R1-1611874 Further discussion on the CSI-RSRP reporting for E-CID enhancements Huawei, HiSilicon
R1-1611875 Further discussion on the UE Rx-Tx measurement over multiple serving cells Huawei, HiSilicon

R1-1611876 WF on the CSI-RSRP reporting for E-CID enhancements Huawei, HiSilicon
Also supported by Intel

6.2.7 Uplink Capacity Enhancements for LTE - *WID in RP-160664*

Finalizing specification of PUSCH in special subframe including the design of scheduling timing for TDD DL/UL configuration 0, HARQ timing for TDD DL/UL configurations 1 to 5, UL DMRS transmission, TBS determination, related signaling and procedures and resolving any remaining issues.

R1-1613703 Chairman's notes of AI 6.2.7 on Uplink Capacity Enhancements for LTE Ad-Hoc chair (Ericsson)

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Endorsed

R1-1611171 Remaining issues on Scheduling and HARQ Timing for PUSCH on UpPTS Huawei, HiSilicon
R1-1611172 Transmission of PUSCH on UpPTSHuawei, HiSilicon
R1-1611347 Remaining details on PUSCH in UpPTS CATT
R1-1611619 PUSCH in UpPTS Qualcomm Incorporated

Agreement

- UCI cannot be transmitted in PUSCH in UpPTS

R1-1612173 Discussion on TTI bundling for PUSCH in UpPTS CMCC
R1-1612174 Discussion on TBS scaling design for PUSCH in UpPTS CMCC
R1-1612175 Discussion on DMRS design for PUSCH in UpPTS CMCC
R1-1612176 Discussion on remaining issues for PUSCH in UpPTS CMCC
R1-1612295 DMRS for PUSCH in UpPTS Panasonic
R1-1612813 Some remaining issues for PUSCH transmission in special subframe Nokia, Alcatel-Lucent Shanghai Bell
R1-1612814 HARQ timing for TTI bundling for PUSCH transmission in special subframe Nokia, Alcatel-Lucent Shanghai Bell

R1-1613359 Offline discussion on remaining issues for PUSCH in UpPTS CMCC

Agreements

- Support both adaptive and non-adaptive HARQ for TTI bundling considering PUSCH in UpPTS
- Specify the PHICH timing for TTI bundling as follows
  - For scheduled PUSCH transmissions in subframe n, which corresponds to the last TTI in the bundle, a UE shall determine the corresponding PHICH resource in subframe n+k_phich, with k_phich in the following table

TDD UL/DL Config	DL subframe number *n*									
	0	1	2	3	4	5	6	7	8	9
2		7	6				7	6		
3		7	6	6	6					

  - The UE shall upon detection of a PHICH transmission intended for the UE in subframe *n-l*, adjust the corresponding first PUSCH transmission in the bundle in subframe *n+k,* with l in the following table

TDD UL/DL Configuration	DL subframe number *n*									
	0	1	2	3	4	5	6	7	8	9
2		1					1			
3	1							0	1	

  - Note: The value k refers to the previous agreement from RAN1 #86, as follows below
    - The UE shall upon detection of a PDCCH with DCI format 0 in subframe n intended for the UE, adjust the corresponding PUSCH transmission in subframe n+k, with k in the following table

TDD UL/DL Configuration	DL subframe number *n*									
	0	1	2	3	4	5	6	7	8	9
2		4			4			4		
3	4							4	4	4

  - The number of HARQ processes for subframe bundling operation under TDD configuration 2 and 3 is two.

- The power control timing for PUSCH in UpPTS for TDD configuration 0-6 follows the following Table

TDD UL/DL Configuration	subframe number *i*									
	0	1	2	3	4	5	6	7	8	9
0	-	5	7	7	4	-	5	7	7	4
1	-	6	6	4	-	-	6	6	4	-
2	-	5	4	-	-	-	5	4	-	-
3	-	4	4	4	4	-	-	-	-	-
4	-	4	4	4	-	-	-	-	-	-
5	-	4	4	-	-	-	-	-	-	-
6(LSB of UL index=0 for subframe 2/7)	-	6	7	7	5	-	6	7	7	-
6(LSB of UL index=1 for subframe 2/7)	-	-	6	-	-	-	-	6	-	-

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- For TDD UL/DL configuration 0
  - Support the following for timing from UL grant to PUSCH
    - Change the interpretation of UL index field
      - 1)MSB=1, LSB=0: UE shall upon detection of a PDCCH with DCI format 0/4 in subframe n intended for the UE, adjust the corresponding PUSCH transmission in subframe n+k, with k given in the following table.
      - 2)MSB=0, LSB=1: UE shall adjust the corresponding PUSCH transmission in subframe n+7
      - 3)MSB=1, LSB=1: UE shall adjust the corresponding PUSCH transmission in both subframes n+ k and n+7, with k in the following table

TDD UL/DL Config	DL subframe index n									
	0	1	2	3	4	5	6	7	8	9
0	4	5				4	5			

  - For UL grant to PUSCH timing in TDD UL/DL configuration 6, the LSB=1 in UL index is not allowed for the subframe #9

- If PUSCH transmission in UpPTS is configured, the number of HARQ processes when subframe bundling is not configured follows the following table
  - Note: Compared with the case for existing number of HARQ processes, the modifications are:
    - For TDD UL/DL configuration 0, 1, 2 and 6, two more HARQ processes are added,
    - For TDD UL/DL configuration 3-5, one more HARQ process is added

TDD UL/DL configuration	Number of HARQ processes
0	9
1	6
2	4
3	4
4	3
5	2
6	8

- DMRS for PUSCH in UpPTS is transmitted in the UpPTS,
  - DMRS is transmitted in the symbol index *l*=3 for normal CP, and the symbol index *l*=2 for extended CP.

Conclusion
No consensus to introduce the following:
- The UE can be configured by RRC not to transmit DMRS for PUSCH in UpPTS per carrier
  - This configuration is a UE capability
  - Note 1: RAN1 assumes that the power and phase of the PA is not changed between PUSCH in UpPTS and PUSCH in the following UL subframe
  - Note 2: RAN1 assumes for the above configurations that the UE is configured with Ks=0, is scheduled with the same PRBs in both UpPTS and the following UL subframe on all UL carriers, open loop component in the power control is the same in PUSCH in UpPTS and the following UL subframe, TPC command should not be updated between the UpPTS PUSCH and PUSCH in the following UL subframe, simultaneous PUSCH and PUCCH is not configured, the phase in the PA is kept in the case that there is an empty OFDM(s) between the PUSCH in UpPTS and PUSCH in the following UL subframe, SRS is not transmitted in the PUSCH in UpPTS, UL extended CP is not configured, no collision with PRACH format 4 with PUSCH in UpPTS

R1-1613674 WF on DMRS for PUSCH in UpPTS CMCC, Huawei, HiSilicon, CATT

Agreements
- The number of data symbols for PUSCH in UpPTS is configured per carrier for a given UE by RRC
  - For NCP, the number of data symbols for PUSCH in UpPTS can be 2,3,4,5;
  - For ECP, the number of data symbols for PUSCH in UpPTS can be 1,2,3,4;
- For TBS selection for PUSCH in UpPTS, the PRB scaling factor are chosen based on the following table

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Available SC-FDMA data symbols in PUSCH	1	2	3	4	5
Scaling factor	1/8			3/8	

R1-1613188 WF on non-adaptive retransmission support for PUSCH in UpPTS CATT, CMCC, Qualcomm
Agreements

- The following timing values in red are the PUSCH to PHICH timing for support of PUSCH in UpPTS in TDD UL-DL configuration 1~5

TDD UL/DL Configuration	subframe index n									
	0	1	2	3	4	5	6	7	8	9
1		5					5			
2		7					7			
3		7								
4		7								
5		7								

  - Note: The timing values in red are added on top of already agreed timings values
- The following timing values in green are the PHICH to PUSCH retransmission timing for support of PUSCH in UpPTS in TDD UL-DL configuration 1~5

TDD UL/DL Configuration	subframe index n									
	0	1	2	3	4	5	6	7	8	9
1		5					5			
2				3					3	
3									3	
4									3	
5									3	

  - Note: The timing values in green are added on top of already agreed timings values

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R1-1613320 RRC parameters for PUSCH in UpPTS CMCC
R1-1613322 RRC parameters for PUSCH in UpPTS CMCC
R1-1613323 [Draft] LS on RRC parameters for PUSCH in UpPTS CMCC
Agreed in R1-1613330 with update according to the LS template

R1-1613321 Draft LS on PUSCH in UpPTS CMCC
Agreed in R1-1613331

6.2.8 Further Enhanced MTC for LTE- WID in RP-161464

R1-1613704 Chairman's notes of AI 6.2.8 on Further Enhanced MTC for LTE Ad-Hoc chair (Ericsson)
The document was presented by Johan Bergman from Ericsson.
Discussion: Ad-hoc chair (Ericsson) indicated that the FFS under DCI design for multicast topic can be unlighted, and requested the need for an email thread regarding RRC parameters.
Decision: The document is endorsed and content incorporated below.

Email approval of RRC parameter lists until 24th Nov. – Johan (Ericsson)

6.2.8.1 Higher data rates

Contributions relevant for more than one sub-topic (e.g. joint DCI design) are submitted to this agenda item

R1-1611181 On enabling and disabling of feMTC sub-features Huawei, HiSilicon
R1-1611620 Support of higher data rates Qualcomm Incorporated
R1-1611717 Details of Retuning Symbols for FeMTC in Rel-14 NEC
R1-1612607 Design of DCI and scheduling for higher data rate Kyocera Corporation
R1-1612700 Views on remaining issues of improving data rate for FeMTC NTT DOCOMO, INC.

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6.2.8.1.1 Larger max PDSCH/PUSCH channel bandwidth

Narrowband/wideband definition, frequency hopping, etc. (for BL and non-BL UEs)

R1-1613339 WF on WF on PDSCH/PUSCH channel bandwidth allocation for FeMTC UEs Apple, Ericsson, Intel, XiaoMi, OPPO, Vivo, NEC, Sony, ZTE, LG Electronics, Qualcomm, Sierra Wireless

Agreement:

1. Rel-14 BL/non-BL UE in CE Mode A support independent max PDSCH/PUSCH channel bandwidth configurations.
2. Rel-14 BL/non-BL UE max PDSCH and PUSCH channel bandwidths are configured semi-statically through RRC signaling.
    1. This does not have an impact on whether the Rel-14 DCI formats should be same size or not as Rel-13 DCI formats.

R1-1613358 WF on max channel BW for non-BL UEs Intel

Agreement:

1. The following RAN1 agreement is modified for max channel BW for PUSCH for non-BL UEs
    1. From
        1. Rel-14 non-BL UE can support CE mode A in connected mode with a maximum PDSCH/PUSCH channel bandwidth of either 5 or 20 MHz
    2. To
        1. Rel-14 non-BL UE can support CE mode A in connected mode with a maximum PDSCH channel bandwidth of either 5 or 20 MHz
        2. Rel-14 non-BL UE can support CE mode A in connected mode with a maximum PUSCH channel bandwidth of 5 MHz
2. Rel-14 non-BL UEs can support CE mode B in connected mode with a maximum PDSCH channel bandwidth of either 1.4, 5 or 20 MHz.
3. Rel-14 non-BL UEs can support CE mode B in connected mode with a maximum PUSCH channel bandwidth of 1.4 MHz.

R1-1613293 WF on resource allocation for larger PDSCH/PUSCH channel bandwidth ZTE, ZTE Microelectronics, Sequans, Qualcomm

Proposal:

- Resource allocation is supported for PDSCH with 5 MHz larger channel bandwidth in CE mode A:
    - Distributed/localized
        - Alt 1: Starting narrowband index (or wideband index) + NB bitmap + Resource allocation within existing narrowband
        - Alt 2: Starting narrowband index (or wideband index) + bitmap of RBG within 5-MHz wideband
        - Alt 3: Wideband index + distributed allocation based on Resource allocation type 2 within wideband (including localized/distributed flag)
    - Localized
        - Alt 4: Starting narrowband index + number of PRBs
        - Alt 5: Starting narrowband index + number of NBs
        - Alt 6: Starting RB index + number of RBs
- Continuous resource allocation is supported for PUSCH with 5 MHz larger channel bandwidth in CE mode A:
    - Alt A: Starting narrowband index (or wideband index) + existing PUSCH type 0 within 5-MHz wideband
    - Alt B: Existing PUSCH type 0 (RIV limited)
    - Alt C: Starting RB index + number of RBs
    - Alt D: Starting narrowband index + number of NBs
    - Alt E: Starting NB index + number of RBs

R1-1613656 Draft WF on PDSCH Allocation for FeMTC UEs with Larger BW Qualcomm, ZTE, ZTE Microelectronics, Intel, Ericsson

Agreements:

1. The PDSCH Allocation for FeMTC UEs supporting larger BW is limited to resource blocks that are part of narrow bands defined in LTE Release 13 for UEs configured with 5 MHz max PDSCH channel bandwidth
    1. 24 PRBs is the maximum number of PRBs that can be allocated
2. The PDSCH Allocation for FeMTC UEs supporting larger BW is limited to resource blocks that are part of narrow bands defined in LTE Release 13 for UEs configured with 20MHz max PDSCH channel bandwidth
    1. 96 PRBs is the maximum number of PRBs that can be allocated
3. The PUSCH allocation for FeMTC UEs with larger BW can include at least certain PRBs that are not part of narrow bands defined in LTE Release 13
    1. This includes at least the central PRB in case of odd system bandwidth
    2. FFS: PRBs at the band edges that do not belong to any narrowband

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R1-1613537 WF on resource allocation for PDSCH with 5 MHz channel bandwidth ZTE, ZTE Microelectronics, Sequans, Qualcomm, Ericsson, Sony

Agreement:

1. For Rel-14 BL/CE UE configured with max 5 MHz PDSCH channel bandwidth, contiguous and non-contiguous resource allocation is supported
1. For Rel-14 non-BL UEs configured with max 20 MHz PDSCH channel bandwidth, contiguous and non-contiguous resource allocation is supported

R1-1613673 WF on Rel-14 resource allocation NEC, Huawei, HiSilicon, Lenovo, MotoM

Proposal:

- Resource allocation for CE Mode A:
  - First narrow band is always allocated and it is indicated by $\left\lceil \log_2 \left\lfloor \frac{N_{RB}^{XL}}{6} \right\rfloor \right\rceil$ (note X stands for D or U)
  - The remaining 3 bits (11**xxx**) are used as a bit map for the remaining 3 narrowbands
- Resource allocation for DL CE Mode B is FFS

Conclusion: Continue discussion at RAN1#88.

R1-1611481 Frequency hopping support for FeMTC Nokia, Alcatel-Lucent Shanghai Bell

Agreement:

- PDSCH/PUSCH frequency hopping is supported for BL/CE UE operating 5 MHz maximum PDSCH/PUSCH channel bandwidth.
  - Reuse Rel-13 frequency hopping RRC parameters.
  - FFS how to handle center PRB in odd system bandwidths
  - FFS whether wrap-around can occur
- It is up to eNB implementation to ensure that frequency hopping error cases with wrap-around (e.g. for PUSCH or for PDSCH with UE bandwidth smaller than system bandwidth) do not occur.
  - This does not preclude specifying a UE behavior for these cases.
- PDSCH/PUSCH frequency hopping can be dynamically enabled and disabled via DCI in CE Mode A.

R1-1611097 Larger max channel bandwidth for FeMTC Ericsson
R1-1611182 Further considerations on larger max channel bandwidth in FeMTC Huawei, HiSilicon
R1-1611262 Resource allocation for larger bandwidth feMTC UE Sequans Communications
R1-1611480 Support of larger bandwidth for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611534 Considerations on feMTC operation in 5 MHz Sony
R1-1611621 Support of larger data channel bandwidth Qualcomm Incorporated
R1-1611718 Larger maximum PDSCH/PUSCH channel bandwidth in CE mode A/B NEC
R1-1611760 Wideband operation for FeMTC LG Electronics
R1-1611934 On support of larger max channel BW for feMTC Intel Corporation
R1-1611935 Frequency domain resource allocation for feMTC UEs with larger max channel BW Intel Corporation
R1-1612593 Detailed solutions to support larger PDSCH/PUSCH bandwidth for MTC ZTE
R1-1612626 PDSCH/PUSCH channel bandwidth allocation for FeMTC UEs Apple Switzerland AG

6.2.8.1.2 Larger max PDSCH/PUSCH TBS

TBS/MCS table, soft buffer size, etc. (for BL and non-BL UEs)

R1-1613356 WF on TBS for Rel-14 BL/CE UEs Intel Corporation, Nokia, ASB, Ericsson, ZTE, Qualcomm

Agreement:

1. Use 4-bit MCS field for PDSCH/PUSCH for BL/CE UE configured with larger max PDSCH/PUSCH channel bandwidth.
2. For BL/non-BL UE configured with max 5 MHz PDSCH/PUSCH channel bandwidth in CE mode A, adopt TBS table for PDSCH/PUSCH in R1-1613356.
3. For BL/non-BL UE configured with max 5 MHz PDSCH/PUSCH channel bandwidth in CE mode B, adopt TBS table for PDSCH/PUSCH in R1-1613356 with $I_{TBS} \leq 9$.
4. For non-BL UE configured with max 20 MHz PDSCH channel bandwidth, max DL TBS is 31704 bits.

R1-1613357 WF on soft buffer size for 5MHz Rel-14 BL UEs Intel, Qualcomm

Agreement:

1. Soft buffer size for 5-MHz BL UE is 73152 bits (75% of full buffer size corresponding to a max TBS of 4008 bits and 8 DL HARQ processes).

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1. The same soft buffer size (73152 bits) applies to 5-MHz BL UE supporting 10 DL HARQ processes.

R1-1613587 WF on rate matching for 5MHz BL UEs Intel
Agreement:
1. PDSCH rate matching for 5-MHz BL UEs uses Limited Buffer Rate Matching (LBRM) with 25% reduction of buffer size, corresponding to a code rate of 4/9

R1-1611098 Larger max TBS for FeMTC Ericsson
R1-1611184 On supporting larger max PDSCH/PUSCH TBS in FeMTC Huawei, HiSilicon
R1-1611482 Support for larger maximum TBS for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611936 Soft buffer requirements for feMTC UEs with larger max TBS Intel Corporation
R1-1612594 Discussion on larger maximum PDSCH/PUSCH TBS for FeMTC ZTE

6.2.8.1.3 HARQ-ACK bundling in HD-FDD

HARQ-ACK bundling scheme, potential FD-FDD applicability, etc.

R1-1613292 WF on HARQ-ACK bundling in HD-FDD ZTE, ZTE Microelectronics, Ericsson, Sierra Wireless, Sony, Huawei, HiSilicon
Agreement:
1. When HARQ-ACK bundling is RRC configured, non-bundled transmission is still possible, where the repetition numbers of the different channels are used in the same way as in Rel-13 eMTC.
2. At least in non-repetition case, the maximum number of HARQ-ACK bundles before switching to UL is 3.
    1. FFS whether repetition case is supported
3. The maximum number of PDSCH TBs in all bundles before switching to UL is 10.
4. The switch time between DL and UL is FFS between:
    1. Indicated in the DCI
    2. Implicitly based on the specification

R1-1613648 WF on repetition for HARQ-ACK bundling Huawei, HiSilicon, Ericsson, NTT DOCOMO, NEC, ZTE, Intel, Qualcomm
Agreement:
1. If repetition is used for M-PDCCH or PDSCH, HARQ-ACK bundling is not used
Continue discussion at RAN1#88.

R1-1611099 HARQ-ACK bundling for FeMTC Ericsson
R1-1611263 HARQ-ACK bundling schemes Sequans Communications
R1-1611483 HARQ-ACK bundling for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611535 Considerations on HARQ-ACK bundling for HD-FDD feMTC Sony
R1-1611622 Support of HARQ-ACK bundling in HD-FDD Qualcomm Incorporated
R1-1611719 Different Options for HARQ-ACK bundling in CE mode A for HD-FDD NEC
R1-1611888 HARQ-ACK bundling Huawei, HiSilicon
R1-1612095 Design of HARQ-ACK bundling for HD-FDD Lenovo
R1-1612380 HARQ Bundling Considerations Sierra Wireless, S.A.
R1-1612595 Detailed design of HARQ-ACK bundling in HD-FDD ZTE

6.2.8.1.4 DCI definition

Resource allocation and DCI definition for all sub-features for higher data rates (for BL and non-BL UEs)

R1-1613318 WF on 10 HARQ Processes Operation Sony, Sierra Wireless
Also supported by Nokia, Ericsson, ZTE, Intel, Sequans
Working assumption:
1. When the 10 HARQ process feature is enabled by RRC,
    1. The HARQ Process Number field in the DCI is increased to 4 bits.

R1-1611188 DL HARQ process indication in CE mode A Huawei, HiSilicon
R1-1611100 Resource allocation and DCI definition for FeMTC Ericsson
R1-1611183 DCI design for supporting wider bandwidth in FeMTC Huawei, HiSilicon
R1-1611484 DCI design for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611536 DCI for 10 HARQ Process operation in feMTC Sony
R1-1611720 Resource allocation schemes for FeMTC UEs NEC
R1-1611937 DCI design options for higher data rates for feMTC Intel Corporation
R1-1612096 DCI design on supporting larger bandwidth in FeMTC Lenovo
R1-1612596 Resource allocation for larger PDSCH/PUSCH channel bandwidth ZTE

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R1-1612597 Considerations on DCI design for higher data rate ZTE

6.2.8.1.5 Others

R1-1613335 WF on remaining issues for Retuning NEC, Ericsson, Intel

Agreement:

1. If the UE indicates it needs one symbol for retuning, then:
    1. When retuning between two PUSCH narrowbands, the guard period is the last SC-FDMA symbol in the previous UL subframe
    2. When retuning between two PUCCH resources, the guard period is the last SC-FDMA symbol in the previous UL subframe
    3. When retuning from a PUSCH narrowband to a PUCCH resource, the guard period is the last SC-FDMA symbol in the previous UL subframe
    4. When retuning from a PUCCH resource to a PUSCH narrowband,
        1. If the PUCCH uses a shortened PUCCH format, the guard period is the last SC-FDMA symbol in the previous UL subframe and any potential SRS transmission is dropped.
        2. Otherwise, the guard period is the first SC-FDMA symbol in the next UL subframe.

R1-1611485 Remaining details of retuning gaps Nokia, Alcatel-Lucent Shanghai Bell
R1-1611938 Support of enhanceed retuning for BL UEs Intel Corporation

6.2.8.2 Multicast support

SC-MTCH and SC-MCCH transmission/configuration, DCI formats, remaining details of search spaces, change notification

R1-1613129 WF on search space design for multicast in FeMTC Ericsson, Nokia, ASB, ZTE, Intel

Agreement:

1. MPDCCH search space configuration for SC-MCCH consists of {narrowband, Rmax, G}.
2. MPDCCH search space configuration for SC-MTCH consists of {narrowband, Rmax, G}.
3. For the MPDCCH search space scheduling SC-MCCH, UE monitoring of blind decoding candidates is reused from Type1-CSS.
4. For the MPDCCH search space scheduling SC-MTCH, UE monitoring of blind decoding candidates is reused from Type2-CSS.

R1-1613131 WF on DCI design for multicast in FeMTC ZTE, Nokia, ASB, Ericsson

Agreement:

1. DCIs for scheduling SC-MCCH is based on DCI format 6-2 with at least the following fields:
    1. Resource assignment
    2. Number of PDSCH repetitions
    3. MCS
    4. Number of MPDCCH repetitions
2. DCIs for scheduling SC-MTCH include at least the following fields:
    1. Frequency-hopping flag
    2. Resource assignment
    3. Number of PDSCH repetitions
    4. MCS
    5. Number of MPDCCH repetitions
3. The sizes of the DCI fields are FFS.
4. Other DCI fields than the ones listed above are not precluded.

R1-1613132 WF L1 configurations for multicast in FeMTC Ericsson

Agreement:

1. PDSCH carrying SC-MCCH supports up to 1000 bits TBS and up to 6 PRBs channel bandwidth.
1. PDSCH carrying SC-MTCH is configurable in SC-MCCH, and supports up to [4008] bits TBS and [24 or 25] PRBs channel bandwidth.
2. For MPDCCH scheduling SC-MCCH or SC-MTCH, the frequency hopping and its configuration follow the Rel-13 eMTC design.
3. For PDSCH carrying SC-MCCH or SC-MTCH, the frequency hopping and its configuration follow the Rel-13 eMTC design.
4. The frequency hopping activation (ON/OFF) for MPDCCH/PDSCH for SC-MCCH is configured by a new 1-bit parameter.
5. The frequency hopping activation (ON/OFF) for MPDCCH/PDSCH for SC-MTCH is configured by a new 1-bit parameter per SC-MTCH.
6. Coverage enhancement related settings (CE mode A / CE mode B) for MPDCCH/PDSCH for SC-MCCH are configured by a new 1-bit parameter.

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7. Coverage enhancement related settings (CE mode A / CE mode B) for MPDCCH/PDSCH for SC-MTCH is configured by a new 1-bit parameter per SC-MTCH.

R1-1613130 WF on FeMTC multicast collision handling Ericsson, Nokia, ASB, Intel

Working assumption:

1. When a UE is monitoring Type1-CSS for paging at its Paging Occasion, it is not required to simultaneously monitor MPDCCH search spaces for SC-MCCH or SC-MTCH or receive PDSCH for SC-MCCH or SC-MTCH.
2. This working assumption is automatically confirmed/abandoned if the corresponding RAN2 working assumption is confirmed/abandoned.

Agreement:

3. Collision between SC-PTM related transmissions and PSS/SSS, PBCH, and SIBs, is handled in the same way as Rel-13 eMTC.
1. The UE is not required to simultaneously monitor the MPDCCH search spaces for SC-MCCH and SC-MTCH.
2. When a UE is monitoring MPDCCH search space for SC-MCCH or receiving PDSCH carrying SC-MCCH, it is not required to simultaneously monitor MPDCCH search space for SC-MTCH or receive PDSCH carrying SC-MTCH.

R1-1611101	Search space and DCI design for multicast for FeMTC	Ericsson
R1-1611102	L1 configuration of multicast for FeMTC	Ericsson
R1-1611185	On SC-PTM transmission for FeMTC	Huawei, HiSilicon
R1-1611486	FeMTC Search Space Design for SC-MCCH and SC-MTCH	Nokia, Alcatel-Lucent Shanghai Bell
R1-1611487	Feedback options for SC-MTCH	Nokia, Alcatel-Lucent Shanghai Bell
R1-1611488	SPS design for SC-MTCH	Nokia, Alcatel-Lucent Shanghai Bell
R1-1611537	Considerations on multicast operation in feMTC	Sony
R1-1611623	Support of multicast	Qualcomm Incorporated
R1-1611761	Multicast support for FeMTC	LG Electronics
R1-1611939	SC-PTM support for feMTC	Intel Corporation
R1-1612598	Remaining issues on multicast support for MTC	ZTE

6.2.8.3 OTDOA enhancements

Consider improvements of accuracy, UE complexity and power consumption

R1-1613541 WF on OTDOA enhancements for FeMTC Ericsson, Sony, Qualcomm, ZTE, ZTE Microelectronics, Nokia, ASB, Verizon
Also supported by Acorn Technologies

Agreement:

- PRS bandwidths include {1.4, 3, 5, 10, 15, 20} MHz
  - No change w.r.t. legacy LTE PRS bandwidths
  - One cell can transmit multiple PRS time-frequency configurations with possibly up to [3] different PRS bandwidths
  - Configuration information multiple PRS time-frequency configurations with possibly up to [3] different PRS bandwidths per cell can be signaled to the UE, each information associated with a set of configuration parameters including PRS configuration index, number of PRS subframes per occasion, muting pattern, and new optional parameters
- Supported legacy PRS periodicities are {160, 320, 640, 1280} subframes that are jointly signaled with starting subframe offsets in PRS configuration indices
  - No change w.r.t. legacy LTE PRS indices
- Supported number of PRS subframes per PRS occasion are {1, 2, 4, 6, 10, 20, 40, 80, 160} subframes
- Reuse LTE PRS muting mechanism with a bit string of {2, 4, 8, 16} bits, with each bit applied to one legacy PRS period
  - No change w.r.t. legacy LTE PRS muting pattern
- Add additional configuration parameters to support more frequent PRS transmissions and PRS frequency hopping
- Legacy PRS configuration (including R14 enhancements) can also be delivered to (F)eMTC UEs
- To support more frequent PRS transmission in time, add the following parameters to support multiple PRS occasions in a legacy PRS period
  - PRS occasion interval in a PRS period: {10, 20, 40, 80} subframes
    - If this is not configured, there is only one PRS occasion in a legacy PRS period.

Proposal:

- FFS: An optional finer muting pattern can be applied to PRS occasions in a legacy PRS period
  - The muting of the first PRS occasion in a legacy PRS period follows the existing PRS muting

Agreement:

- If activated, PRS frequency hopping is configured with the following parameters (similar to Rel-13 eMTC FH):

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- Number of bands for frequency hopping X: {2, 4}
  - The first band is in the center
- The positions of the remaining X-1 bands:
  - The starting position of each of X-1 bands is indicated separately: narrowband {0,1,…,max-1}

Proposal:

- Frequency hopping interval: FFS between the two following options:
  - Option 1: {1, 2, 4, 8} SFs for FDD and {1, 5, 10, 20} SFs for TDD
  - Option 2: one PRS occasion
- FFS: The hopping pattern starts in every radio frame fulfilling SFN mod 8 = 0
- FFS: When frequency hopping is enabled, the UE can assume that the same precoder is used within one frequency hopping interval

R1-1613625 WF on UE Capability Indication Enhancement for OTDOA Positioning in FeMTC Nokia, Alcatel-Lucent Shanghai Bell, Ericsson, Qualcomm, Verizon

Agreement:

- Signalling is provided for the UE to indicate the capability information below for OTDOA positioning to the E-SMLC in LPP
  - Maximal PRS bandwidth for RSTD measurement
  - PRS-frequency-hopping-based RSTD measurement

R1-1611103 PRS configurations for FeMTC Ericsson
R1-1611104 PRS frequency location determination for FeMTC Ericsson
R1-1611186 Evaluations of feMTC OTDOA Huawei, HiSilicon
R1-1611489 PRS Configuration for OTDOA Positioning in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611490 PRS Muting Pattern for OTDOA Positioning in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611491 UE Capability Indication Enhancement for OTDOA Positioning in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-1611538 OTDOA for feMTC Sony
R1-1611539 Increasing accuracy of OTDOA in feMTC Sony
R1-1611625 OTDOA enhancements Qualcomm Incorporated
R1-1612601 OTDOA for eMTC ZTE

Send an LS to RAN2/3/4 with positioning related agreements – Johan - R1-1613493

Friday

R1-1613493 **[DRAFT] LS on Rel-14 FeMTC OTDOA enhancements** **Ericsson**

Decision: The document is noted and final LS is approved in R1-1613760.

6.2.8.4 VoLTE enhancements

Increase VoLTE coverage for half-duplex FDD/TDD through techniques to reduce DL repetitions, new repetition factors, and adjusted scheduling delays

R1-1613381 WF on VoLTE enhancements for FeMTC Ericsson, Huawei, HiSilicon, Sequans, Sierra Wireless, Sony

Agreements:

1. On 'new number(s) of repetitions for PUSCH':
   1. Define a new set of repetition factors for PUSCH which overrides the SIB parameter for the maximum number of PUSCH repetitions
   2. At least for the non-SPS case, the new set of repetition factors is {1, 2, 4, 8, 12, 16, 24, 32}
   3. The new set of repetition factors is enabled by a new optional 1-bit UE-specific RRC configuration parameter
2. On 'adjusted scheduling relationships between physical channels':
   1. Introduce a dynamic timing relationship between PDSCH and HARQ-ACK controlled by the DCI
      1. This adjusted timing relationship is enabled by a new optional 1-bit UE-specific RRC configuration parameter
   2. FFS whether to introduce a dynamic timing relationship between UL grant and PUSCH
      1. If introduced, this will not require the introduction of any additional RRC parameters.
   3. FFS whether to introduce a dynamic timing relationship between DL assignment and PDSCH
      1. If introduced, FFS whether the modified scheduling delay is implicitly detected based on guard-subframe timing
3. On 'SRS coverage enhancement':
   1. P-SRS can be transmitted on at most 6 UpPTS symbols in the same subframe for the same FeMTC UE
   2. A-SRS can be transmitted on at most 6 UpPTS symbols in the same subframe for the same FeMTC UE
   3. Use similar RRC signalling as introduced for the corresponding functionality in the Rel-14 WI for SRS-based carrier switching
   4. This is an optional UE capability

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Note that the above three enhancements are not limited to VoLTE

R1-1613390 Draft WF on delayed DL grant Sequans
Proposal:
- FFS whether delayed scheduling is introduced for Rel-14 FeMTC
  - If introduced, FFS whether the modified scheduling delay is implicitly detected based on guard-subframe timing

R1-1611105 Repetition factors for delay sensitive traffic in CE mode A Ericsson
R1-1611187 VoLTE enhancements in FeMTC Huawei, HiSilicon
R1-1611264 VoLTE with Cat-M1 - overview Sequans Communications
R1-1611265 VoLTE with Cat-M1 - enhancements Sequans Communications
R1-1611315 Timing relationships for delay sensitive traffic in CE mode A Ericsson
R1-1611492 VoLTE enhancements Nokia, Alcatel-Lucent Shanghai Bell
R1-1611626 VoLTE enhancements for eMTC Qualcomm Incorporated
R1-1611889 SRS enhancement for supporting higher data rates Huawei, HiSilicon
R1-1611940 Enhanced VoLTE support for Rel-14 feMTC UEs Intel Corporation
R1-1612604 VoLTE enhancement for eMTC ZTE

6.2.8.5 Others

R1-1611627 Paging channel enhancements Qualcomm Incorporated
R1-1611628 Power consumption reduction techniques for eMTC Qualcomm Incorporated

6.2.9 Enhancements of NB-IoT - *WID in RP-161901.*

The objectives apply to the in-band, guard-band, and standalone operation modes and the same coverage enhancement targets as defined in the Rel-13 NB-IoT work item.

R1-1613705 **Chairman's notes of AI 6.2.9 on Enhancements of NB-IoT Ad-Hoc chair (Huawei)**
The document was presented by Matthew Webb from Huawei.
Discussion: Ad-Hoc chair (Huawei) indicated the following two corrections from the notes:
1/ Statement "of neighboring cell" can be deleted from the agreements of NPRS pattern for standalone and guard-band scenario (AI 6.2.9.1.1)
2/ Statement "FFS: Part B on its own, and Part B when used together with Part A" can be deleted from the agreements on NPRS subframe configuration (AI 6.2.9.1.2)
Decision: The document is endorsed and content incorporated below.

R1-1611873 Draft RRC parameter list for NB-IoT enhancements Huawei
R1-1612377 RAN1 agreements for Rel-14 NB-IoT Ericsson

Email approval for the higher layer parameters list and send to RAN2 until November 25 (Matthew, Huawei)

6.2.9.1 Positioning

6.2.9.1.1 Design of narrowband OTDOA positioning reference signal

R1-1611116 On NPRS RE pattern design Ericsson
R1-1611143 Design of downlink positioning reference signal for NB-IoT Huawei, HiSilicon
R1-1611762 Design of NPRS for eNB-IoT LG Electronics

R1-1613294 WF on NPRS pattern for NB-IoT OTDOA ZTE , ZTE Microelectronics,ITL…
R1-1613690 NPRS pattern for NB-IoT OTDOA ZTE , ZTE Microelectronics, HW, HiSilicon, Qualcomm

Agreements
For inband scenario
- If NPRS subframe configuration is part A or Part A + Part B, legacy LTE PRS pattern in one PRB is adopted
- The NPRS location in slot is generated by the formula below

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$$k = 6\left(m + 2\cdot n_{\text{PRB}}\right) + \left(6 - l + v_{\text{shift}}\right) \bmod 6$$

$$l = \begin{cases} 3,5,6 & \text{if } n_s \bmod 2 = 0 \\ 1,2,3,5,6 & \text{if } n_s \bmod 2 = 1 \text{ and } (1 \text{ or } 2 \text{ PBCH antenna ports}) \\ 2,3,5,6 & \text{if } n_s \bmod 2 = 1 \text{ and } (4 \text{ PBCH antenna ports}) \end{cases}$$

$$m = 0,1$$

where n_s is the slot number within a radio frame; l is the OFDM symbol number within slot n_s ; k is the subcarrier index within LTE bandwidth which is used for NB-IoT NPRS transmission; n_{PRB} is the PRB index within LTE bandwidth which is used as NB-IoT NPRS PRB; v_{shift} is the cell-specific frequency shift generated by $v_{\text{shift}} = N_{\text{ID}}^{\text{PRS}} \bmod 6$,where $N_{\text{ID}}^{\text{PRS}}$ equals $N_{\text{ID}}^{\text{Ncell}}$ unless configured by higher layers.

- Note: It is assumed v_{shift} , $N_{\text{ID}}^{\text{PRS}}$, $N_{\text{ID}}^{\text{Ncell}}$, and PBCH antenna ports number will be signaled by higher layers.
- If NPRS subframe configuration is part B only, NPRS is punctured in OFDM symbols 5 and 6 in each slot

Agreements:
For standalone and guard-band scenario

- If NPRS subframe configuration is part A or Part A+ Part B, the pattern in the figure below is adopted
- The NPRS location in slot is generated by the formula list below:

$$k = 6m + \left(6 - l + v_{\text{shift}}\right) \bmod 6$$

$$l = 0,1,2,3,5,6$$

$$m = 0,1$$

where l is the OFDM symbol number within slot ; k is the subcarrier index within LTE bandwidth which is used for NB-IoT NPRS transmission; v_{shift} is the cell-specific frequency shift generated by $v_{\text{shift}} = N_{\text{ID}}^{\text{PRS}} \bmod 6$,where $N_{\text{ID}}^{\text{PRS}}$ equals $N_{\text{ID}}^{\text{Ncell}}$ unless configured by higher layers.

- Note: It is assumed v_{shift} , $N_{\text{ID}}^{\text{PRS}}$, $N_{\text{ID}}^{\text{Ncell}}$ ~~of neighboring cell~~ will be signaled by higher layers.
- If NPRS subframe configuration is part B, NPRS is punctured in OFDM symbols 5 and 6 in each slot

R1-1611540 OTDOA for eNB-IoT Sony
R1-1612986 NPRS Design for OTDOA Positioning Fraunhofer IIS

R1-1611118 On NPRS performance Ericsson
R1-1611145 Evaluation of downlink positioning accuracy for NB-IoT Huawei, HiSilicon
R1-1611872 Analysis of power consumption and complexity for NB-IoT downlink positioning Huawei, HiSilicon
R1-1612790 A new system simulator for NB-IoT positioning Ericsson

6.2.9.1.2 Remaining details of narrowband OTDOA positioning configuration

R1-1611117 On the remaining details of narrowband OTDOA positioning configurations Ericsson
R1-1611144 Configuration of downlink positioning reference signal for NB-IoT Huawei, HiSilicon
R1-1611629 OTDOA positioning reference signal Qualcomm Incorporated
Section 3
R1-1612602 OTDOA for NB-IoT ZTE
R1-1611302 NPRS Muting Pattern for OTDOA Positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

R1-1613296 WF on NPRS subframe configuration for NB-IoT OTDOA ZTE, ZTE Microelectronics

Agreements:

- NPRS is configured per NB-IoT carrier transmitting NPRS
  - Each NB-IoT carrier can have different configuration parameter
  - Part A:A bitmap for NPRS subframe indication in one NPRS occasion
    - bitmap length is the same as valid subframe configuration, i.e. 10 bits or 40 bits
    - Subframes not containing NPRS are indicated with '0'
    - Subframes containing NPRS are indicated with '1'

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– ~~FFS: Part B on its own, and Part B when used together with Part A~~

R1-1613444 WF on PRS configuration for NB-IoT UEs Qualcomm, Huawei, HiSilicon, ITL, Acorn Technologies, Nokia, Alcatel-Lucent Shanghai Bell

Agreements:

- Signalling is provided for the UE to indicate its capability of maximal bandwidth for RSTD measurement for OTDOA positioning to the E-SMLC in LPP
- An NB-IoT UE can receive assistance information regarding LTE PRS.
  - ~~o~~ This includes additional PRS configurations introduced in Rel-14 Indoor Positioning and FeMTC work items (if any).
- UE is not required to receive any reference signal not within the bandwidth of one NB-IoT carrier containing NPRS at a time.
- RAN4 are requested to set requirements for NB-IoT positioning assuming UE uses only NPRS within one carrier.
  - ~~o~~ Additionally or alternatively, an NB-IoT UE can receive assistance information regarding 1-PRB NPRS
  - ~~o~~ For Part-B NB-IoT specific assistance information:
    - Number of subframes of NPRS in one occasion is N_{PRS} {10, 20, 40, 80, 160, 320, 640, 1280}
    - Periodicity of NPRS occasion T_{PRS}: 160ms, 320ms, 640ms, 1280ms.
    - Valid configurations are those satisfying $N_{PRS} <= T_{PRS}$
    - For a given periodicity of NPRS occasion, the starting subframe offset of NPRS occasion = $\alpha T_{PRS}, \alpha \in \{0, \frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}\}$

R1-1613526 Way forward on NPRS sequence generation Huawei, HiSilicon, Ericsson, Nokia, ZTE, ZTE Microelectronics

Agreements

- NPRS sequence is determined based on a subsequence of length-2 truncated from PRS sequence introduced in Rel-14 for further indoor positioning enhancements.
  - For stand-alone and guard band operations, the length-2 NPRS sequence is the central 2 elements of Rel-14 PRS sequence.
  - For in-band operation, the length-2 NPRS sequence is truncated from Rel-14 PRS sequence corresponding to the LTE PRB of the NB-IoT carrier.

R1-1613215 Way forward on NPRS muting pattern Huawei, HiSilicon

Agreements:

- Muting pattern
  - Support 2, 4, 8, and 16 bit bitstring
  - Each bit in a muting pattern corresponds to:
    - For Part A, consecutive 10 subframes
    - For Part B, one NPRS occasion
  - Per NB-IoT carrier, one muting pattern is signaled associated with Part A (if configured) and one muting pattern is signaled associated with Part B (if configured)

Agreement:

- If part A and part B are both configured then a subframe contains NPRS if both configurations indicate it contains NPRS

Proposal

- Send LS to RAN2,3,4 containing the agreements on narrowband OTDOA positioning reference signal and Remaining details of narrowband OTDOA positioning configuration (Alberto, Qualcomm)

Friday

R1-1613739 **[DRAFT] LS on OTDOA agreements for NB-IoT Qualcomm**

Decision: The document is noted and final LS is approved in R1-1613761 with following update (first correction indicated by Ad-Hoc chair from his notes)

- Note: It is assumed v_{shift}, N_{ID}^{PRS}, N_{ID}^{Ncell} ~~of neighboring cell~~ will be signaled by higher layers.

R1-1613471 WF on NRS presence in non-anchor PRBs Qualcomm, Intel, Sony
Also supported by Sierra Wireless

R1-1613679 WF on NB-IoT Rel-14 non-anchor NRS presence during paging reception, random access response, NRSRP & RLM measurements Ericsson

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R1-1611763 OTDOA configuration for eNB-IoT LG Electronics
R1-1611630 Configuration options for OTDOA Qualcomm Incorporated
R1-1611301 NPRS Configuration for OTDOA Positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

R1-1611864 Discussion on NPRS configuration and RSTD measurement gap MediaTek

Agreements:
- UE is not required to receive NPSS/NSSS, NPBCH, NPDCCH, NPDSCH, nor transmit, during RSTD measurements.
- Send the above agreement in a LS to RAN2, RAN4

R1-1613467 [DRAFT] LS on RSTD measurement for Rel-14 NB-IoT positioning RAN1
Source should be MediaTek[RAN1]

The LS in R1-1613467 is approved, with the following change:
Considering ~~a low complexity~~ NB-IoT UE is low complexity
Final LS is in R1-1613468.

R1-1611303 RSTD Measurement and Reporting in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

R1-1612795 On OTDOA framework for NB-IoT Ericsson
R1-1611304 UE Capability Indication Enhancement for OTDOA Positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

6.2.9.1.3 Narrowband UTDOA positioning using an existing NB-IoT transmission

R1-1611140 On reusing NPRACH for NB-IoT uplink positioning Huawei, HiSilicon
R1-1611119 NPRACH based UTDOA impact on NB-IoT availability Ericsson
R1-1611305 UTDOA Positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1611631 Uplink-based narrowband positioning Qualcomm Incorporated
R1-1612603 UTDOA for NB-IoT ZTE
R1-1611120 NPRACH based UTDOA performance Ericsson

Proposed observations on use of Rel-13 NPRACH for UTDOA:
- It is possible to configure NPRACH resources such that the eNB can provide a dedicated resource for UTDOA positioning
  - In these configurations, in scenarios where there is mixed use of NPRACH for positioning and normal purposes there would be impact to
    - System capacity
    - NPRACH intra-cell and inter-cell interference
    - Battery life and latency of UEs in other NPRACH resources
- RAN1 concludes its verification of UTDOA in Rel-13.
- Inform RAN3, RAN4 of the above.

Friday
R1-1613564 **WF on UTDOA positioning in NB-IoT Ericsson, Nokia, ASB, Qualcomm, Verizon, Sony, Samsung**
The way forward is proposed to solve the above yellow "proposed observations:
- RAN1 understands the limitations and difficulties of using Rel-13 NPRACH signal for UTDOA based positioning.
- The use of Rel-13 NPRACH signal for UTDOA based positioning is not practically feasible due to significant instability caused by interference when using Rel-13 NPRACH signal for UTDOA based positioning as well as excess UL resource consumption.
- It is proposed RAN1 does not further evaluate UTDOA based position for NB-IoT for Rel-14.
  - This does not preclude the study of UTDOA based positioning for NB-IoT in future releases.

Discussion: ZTE, Huawei do not agree – have a concern with the second bullet
Vodafone: RAN1 WG cannot decide to stop UTDOA on its own – this should be a plenary's decision
Qualcomm: according to the WID, RAN1 has missed to confirm something – accuracy requirements should be confirmed
Intel: Let's RAN decide whether WID needs modification or not
Huawei: the method works – the matter is regarding the achievable accuracy – RAN1 should provide RAN with the current results and let RAN decide
CMCC: suggests drafting an LS to RAN stating that RAN1 could not decide – it is up to the operators to decide whether the achievable accuracy is an issue
Huawei: wants the above proposed observations highlighted in yellow to remain in the minutes

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Ericsson: remove them - RAN1 could not discuss nor agree all proposed observations proposed by Ad-Hoc chair (Huawei) due to lack of time
Nokia: remove both the proposed observation from Huawei and WF from Ericsson – none are endorsed observations
ZTE would like to have such texts captured in the separated Tdoc and reference in chair notes
Decision: The documents is noted.
Conclusion: RAN1 chair will capture the followings in his status report to RAN#74:

- RAN1 could not discuss nor agree all proposed observations proposed by Ad-Hoc chair (Huawei) and proposed observations by R1-1613564

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R1-1611141 Simulation results of reusing NPRACH for NB-IoT uplink positioning Huawei, HiSilicon
R1-1611142 On power consumption and device complexity of reusing NPRACH for NB-IoT uplink positioning Huawei, HiSilicon
R1-1611306 Considerations on support of Rel-13 UEs for UTDOA Nokia, Alcatel-Lucent Shanghai Bell

6.2.9.2 Multicast support

R1-1613421 [draft] LS reply on coverage enhancement in SC-PTM for FeMTC and eNB-IoT Ericsson
Revision of **R1-1613053** [draft] LS reply on coverage enhancement in SC-PTM for FeMTC and eNB-IoT Ericsson
The draft LS in R1-1613421 is endorsed

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R1-1613730 LS reply on coverage enhancement in SC-PTM for FeMTC and eNB-IoT RAN1

Agreement

- Send an LS to RAN2 (Xiaolei, HiSilicon) informing them of
  - Agreements regarding maximum TBS for SC-PTM
  - Agreements regarding DCI formats for scheduling SC-PTM

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R1-1613732 [DRAFT] LS on TBS and DCI formats for NB-IoT multicast Huawei
Agreed in R1-1613763

Search space design and DCI formats
R1-1613087 SC-PTM support for eNB-IoT Intel Corporation
Revision of R1-1611941 SC-PTM support for eNB-IoT Intel Corporation

R1-1611150 NPDCCH search space and DCI formats for multicast in NB-IoT Huawei, HiSilicon
R1-1611307 SC-PTM search space design for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

R1-1613216 WF on search space for NB-IoT SC-PTM Huawei, HiSilicon, Intel, Qualcomm, LGE, ZTE
Also supported by Sony

Agreements:

- UE monitoring of blind decoding candidates of Type1-MSS (SC-MCCH) is the same as the UE monitoring behaviour of Type1-CSS:
- UE monitoring of blind decoding candidates of Type2-MSS (SC-MTCH) is the same as the UE monitoring behaviour of Type2-CSS :

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Agreements:

Value range of parameters for Type1-MSS

Parameter name	Value range
R_{max}	{1,2,4,8,16,32,64,128,256,512,1024,2048}
G	{1.5, 2, 4,8,16,32,48,64}
α_{offset}	{0,1/8,1/4,3/8,1/2,5/8,3/4,7/8}

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Value range of parameters for Type2-MSS

Parameter name	Value range
R_{max}	{1,2,4,8,16,32,64,128,256,512,1024,2048}
G	{1.5, 2, 4,8,16,32,48,64}
α_{offset}	{0,1/4,1/2,3/4}

R1-1611121 NB-IoT Search Space and DCI design for multicast service Ericsson
R1-1611310 DCI formats and SPS support for SC-PTM Nokia, Alcatel-Lucent Shanghai Bell
R1-1611764 Multicast support for eNB-IoT LG Electronics

R1-1613217 WF on DCI formats for NB-IoT SC-PTM Huawei, HiSilicon, Ericsson, ITL

Agreements:

- At least the following fields are introduced in DCI formats for scheduling NPDSCH carrying SC-MCCH/SC-MTCH:
  - Resource assignment: 3 bits, indicate I_{SF} value and reuse the mapping from I_{SF} to N_{SF}.
  - Modulation and coding scheme: 4 bits, indicate I_{MCS} value and use the Rel-14 mapping from I_{MCS} to modulation scheme and TBS.
  - Repetition number: 4 bits, Indicate I_{rep} value and reuse the mapping from I_{rep} to number of repetitions.
  - DCI subframe repetition number: 3 bits for Type-1 MSS and 2 bits for Type2-MSS
- Scheduling delay field is not introduced in DCI format for scheduling SC-MCCH
- Introduce scheduling delay field in DCI format for scheduling SC-MTCH
  - 3 bits field {0, 4, 8, 12, 16, 32, 64, 128} not conditional on Rmax
- The size of the DCI formats is no more than 23 bits
- There can be reserved bits

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SC-MCCH and change notification
R1-1611151 SC-MCCH transmission in NB-IoT Huawei, HiSilicon
R1-1612797 SC-MCCH transmission and configuration for NB-IoT Innovative Technology Lab Co., KT Corp

R1-1613346 WF on reduced interruption of SC-MTCH reception due to SC-MTCH reception due to SC-MCCH acquirement Huawei, HiSilicon

SC-MTCH
R1-1612599 Remaining issues on multicast support for NB-IoT ZTE
R1-1611632 Support of multicast Qualcomm Incorporated
R1-1611152 SC-MTCH transmission in NB-IoT Huawei, HiSilicon

R1-1611309 SC-MTCH transmission reliability and feedback Nokia, Alcatel-Lucent Shanghai Bell
R1-1612254 Discussion on SC-MTCH in NB-IoT Beijing Xinwei Telecom Techn.

Collision handling
R1-1611122 NB-IoT L1 configuration of multicast service Ericsson
R1-1611308 SC-PTM collision handling Nokia, Alcatel-Lucent Shanghai Bell
R1-1611153 Collision handling for multicast in NB-IoT Huawei, HiSilicon

R1-1613345 WF on collision handling in NB-IoT SC-PTM Huawei, HiSilicon

Agreements:

- In case of collision between NPDSCH carrying SC-MTCH/SC-MCCH and NPSS/NSSS, NPBCH, and SIBs, the NPDSCH carrying SC-MTCH/SC-MCCH is postponed.
- In case of collision between Type1-MSS or Type2-MSS and NPSS/NSSS, NPBCH, and SIBs, the NPDCCH is postponed.
- There is at least 4 ms from the end of one Type1-MSS or Type2-MSS to the start of the next Type1-MSS or Type2-MSS
  - This also applies to partial search spaces
- UE is not required to monitor Type1-MSS while receiving NPDSCH carrying SC-MCCH;

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- When a UE is monitoring Type1-MSS or receiving NPDSCH carrying SC-MCCH, it is not required to simultaneously monitor Type2-MSS nor receive NPDSCH carrying SC-MTCH.

Working assumptions, to be confirmed or abandoned after RAN2 decision on their related working assumption:

- NB-IoT UE is not required to monitor Type1-MSS or receive NPDSCHs carrying SC-MCCH when the UE is monitoring its Type1-CSS on paging occasions or receiving NPDSCHs carrying paging.
- NB-IoT UE is not required to monitor Type2-MSS or receive NPDSCHs carrying SC-MTCH when the UE is monitoring its Type1-CSS on paging occasions or receiving NPDSCHs carrying paging message.
- NB-IoT UE is not required to monitor Type1-MSS or Type2-MSS nor receive NPDSCH carrying SC-MCCH/SC-MTCH when UE is receiving/sending messages during a random access procedure.

R1-1613370 WF on larger TBS support issue on SC-PTM for eNB-IoT LG Electronics

Agreements

- Maximum TBS value for NPDSCH carrying SC-MCCH or SC-MTCH is 2536 bits
  - Cat NB-1 UE does not need to receive the NPDSCH if the DCI indicates a TBS larger than 680 bits

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6.2.9.3 Non-anchor PRB enhancements

Transmission of paging on non-anchor PRBs

R1-1611084 LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier RAN2, Ericsson
R1-1613054 [draft] LS reply on LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier Ericsson

Agreement:

- An additional DCI field is introduced in DL grant DCI format(s) for carrier indication for PDCCH ordered NPRACH.
- The size of the field is FFS pending RAN2 decision on the maximum number of UL non-anchor carriers configured for NPRACH per CE level
- Send LS to RAN2 informing them of this agreement, and note that in DCI format N1 there are 8 reserved bits in case of NPDCCH order, and note that RAN1 have not yet decided if there are new DCI formats introduced in Rel-14.

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R1-1613511 [draft] LS reply on LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier Ericsson

The draft LS in R1-1613511 is endorsed, final version in R1-16xxxx (Yutao, Ericsson)

R1-1613731 LS reply on LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier RAN1

R1-1611146 On non-anchor carrier enhancements Huawei, HiSilicon

R1-1611124 NB-IoT Paging on non-anchor PRBs Ericsson
R1-1611633 Non-anchor PRB enhancements Qualcomm Incorporated
R1-1611942 Remaining details of multi-PRB enhancements for eNB-IoT Intel Corporation
R1-1612605 Remaining issues on multiple PRB support for NB-IoT ZTE

R1-1611123 NB-IoT Paging capacity Ericsson
R1-1611313 Paging on non-anchor PRB for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-1611765 Non-anchor PRB enhancement for eNB-IoT LG Electronics

R1-1613371 WF on paging PRB configuration for eNB-IoT LG Electronics, Intel

Agreement

- Do not support paging PRB hopping

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6.2.9.4 Power consumption and latency reduction

Timing relationships in DL and UL for 2 HARQ processes, monitoring and contents of DCI formats

R1-1611126 Power consumption and latency reduction by increasing the maximum NPUSCH transport block size or using two HARQ processes Ericsson
R1-1611127 Power consumption and latency reduction by increasing the maximum NPDSCH transport block size or using two HARQ processes Ericsson
R1-1611943 Power consumption and latency reduction for eNB-IoT Intel Corporation

2 HARQ timing relationships
R1-1611147 On 2 HARQ processes for enhancement of NB-IoT downlink Huawei, HiSilicon

R1-1611148 On 2 HARQ processes for enhancement of NB-IoT uplink Huawei, HiSilicon
R1-1611865 Discussion on downlink timing relationship for 2 HARQ processes MediaTek
R1-1611866 Discussion on uplink timing relationship for 2 HARQ processes MediaTek
R1-1611634 Support of larger TBS and 2 HARQ processes Qualcomm Incorporated
R1-1611311 Timing relationships for 2 HARQ processes Nokia, Alcatel-Lucent Shanghai Bell

R1-1612591 Discussion on 2 HARQ process for eNB-IoTLG Electronics Inc.
R1-1612600 Considerations on timing relationship for 2 HARQ processes for NB-IoT ZTE
R1-1612768 HARQ Timeline for two processes in Rel-14 NB-IoT SoftBank Corp.

R1-1612789 On new NPUSCH Format 2 for supporting the bundling of ACK/NACK for two NPDSCH HARQ processes Ericsson

DCI formats
R1-1611149 DCI formats for 2 HARQ and larger TBS Huawei, HiSilicon
R1-1612787 On new DCI format for the support of two NPDSCH HARQ processes Ericsson
R1-1612788 On new DCI format for the support of two NPUSCH HARQ processes Ericsson

R1-1611867 NPDCCH Monitoring and new DCI format for 2 HARQ processes MediaTek
R1-1611314 DCI formats to support 2 HARQ processes Nokia, Alcatel-Lucent Shanghai Bell

R1-1613508 WF to achieve NB-IoT power consumption and latency reduction Ericsson, Intel, Huawei, Sierra Wireless, Nokia/Alcatel-Lucent Shanghai Bell
Also supported by: HiSilicon, Neul, Deustche Telekom, u-blox

R1-1613351 WF on 2 HARQ processes for NB-IoT MediaTek, Qualcomm, AT&T, DoCoMo, NEC, Nokia, Alcatel-Lucent Shanghai Bell, KDDI, Samsung, Softbank, Sony, Sharp, MTI, APT, Xinwei, ZTE
Also support by: ZTE Microelectronics, LG

Agreements
- There is a new NB-IoT UE category with max UL and max DL TBS of 2536 bits
- Introduce the {1 HARQ + 2536 bits UL/DL TBS} TBS tables in R1-1613508
- Introduce the {2 HARQ + [1352] bits DL TBS, [1800] bits UL TBS and no change to any Rel-13 specification for NPUSCH}
  - After receiving one DL grant, Rel-14 UE is required to continue monitoring any NPDCCH search spaces containing candidates ending at least 2 ms (i.e., $x_1 \geq 2$ ms) before the start of the first NPDSCH.
  - The gap between NPUSCH to any DL reception is ≥ 1ms.
  - Reuse Rel-13 timing relationship and scheduling delay values for each of the 2 HARQ processes
  - HARQ process ID is indicated DL grant DCI with one bit
    - Monitored only in USS
  - FFS TBS table details.
- Soft buffer size is FFS until next RAN1#88
- The support of 2 HARQ by UE is an optional capability, signalling is left to RAN2

Agreement
- Inform RAN2 in an LS of the above agreements (Wuyiling, Huawei)

R1-1613733 [DRAFT] LS on power consumption and latency reduction in NB-IoT Huawei
Agreed in R1-1613764

6.2.9.5 Others

R1-1611312 Aspects for supporting low-power UE Nokia, Alcatel-Lucent Shanghai Bell
R1-1612606 Remaining issues for supporting low-power class UE for NB-IoT ZTE

R1-1613361 WF on initial CE level selection of low power UEs LG

6.2.10 Shortened TTI and processing time for LTE - *WID in RP-161922.*

R1-1613706 Chairman's notes of AI 6.2.10 on Shortened TTI and processing time for LTE Ad-Hoc chair (Ericsson)
Contents incorporated below
Endorsed with following updates

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6.2.10.1 Shortened processing time for 1ms TTI

R1-1611168 Remaining issues on shortened processing time for 1ms TTI Huawei, HiSilicon

Agreement

- For 1 ms TTI shortened processing, support fallback to legacy processing timing n+4 by the search space, i.e. DCI for processing time n+3 are carried in USS of PDCCH and DCI for processing time n+4 are carried in CSS of PDCCH.
  - For PDSCH the HARQ processes of n+3 1ms TTI and n+4 1ms TTI are shared
  - FFS: Possible PUSCH HARQ processes sharing between n+3 1ms TTI and n+4 1ms TTI
  - FFS: UE behaviour in case of n+3 and n+4 collision
  - Note: It is not expected that the eNB will often change between n+3 and n+4 scheduling timing

R1-1611348 HARQ and scheduling timing design for LTE processing timing reduction with 1ms TTI CATT
R1-1611454 Some issues in 1ms TTI with shortened processing time ZTE, ZTE Microelectronics
R1-1611455 HARQ with shortened processing time for 1ms TTI ZTE, ZTE Microelectronics
R1-1611502 Reduced processing for 1ms TTI Ericsson
R1-1611505 HARQ collisions handling with reduced processing time for 1ms TTI Ericsson
R1-1611506 Asynchronous HARQ for PUSCH Ericsson
R1-1611635 Shortened processing time for 1ms TTI for DL Qualcomm Incorporated
R1-1611636 Shortened processing time for 1ms TTI for UL Qualcomm Incorporated
R1-1611766 Remaining issues on shortened processing time for 1ms TTI LG Electronics
R1-1611944 On reducing processing time for 1ms TTI Intel Corporation
R1-1612204 On maximum TA and EPDCCH support for shortened processing time for 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1612205 Dynamic fallback and required scheduling restrictions for 1ms TTI with different processing times Nokia, Alcatel-Lucent Shanghai Bell
R1-1612206 On DCI details for 1ms TTI UL asynchronous HARQ Nokia, Alcatel-Lucent Shanghai Bell
R1-1612207 Interaction between synchronous and asynchronous UL HARQ for 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1612397 Overall operations for processing time reduction with 1ms TTI Samsung
R1-1612398 DCI for processing time reduction with 1ms TTI Samsung
R1-1612399 Fall-back mode operation for processing time reduction with 1ms TTI Samsung
R1-1612400 Discussion on processing time reduction with 1ms TTI Samsung
R1-1612616 Shortened processing time operation for 1ms TTI Sharp
R1-1612617 HARQ-ACK feedback for 1ms TTI with reduced processing time Sharp
R1-1612690 Views on shortened processing time for 1ms TTI NTT DOCOMO, INC.
R1-1612691 HARQ/Scheduling for shortened processing time for 1ms TTI NTT DOCOMO, INC.

R1-1613375 WF on maximum Timing Advance for LTE reduced processing time operation Nokia, Ericsson, AT&T, CMCC, China Telecom, Deutsche Telekom, KDDI, KT Corporation, NTT DOCOMO Inc., Softbank, T-Mobile USA, Verizon, Alcatel-Lucent Shanghai Bell

Proposed agreement

1. Support a maximum timing advance of x=0.33ms for n+3 processing timing for 1ms TTI.
2. Support a maximum timing advance of 0.33ms for sTTI operation for all UL/DL sTTI lengths.

R1-1613400 WF on support shortened processing time for 1ms TTI Mediatek, Qualcomm, Intel, Samsung, LGE

Proposed agreement

- A minimum timing n+3 is supported for UL grant to UL data and for DL data to DL HARQ for UEs capable of operating with reduced processing time only with the following conditions:
  - a maximum allowable TA is reduced to 67us;
  - only when scheduled by PDCCH

Proposed agreement

- Same maximum timing advance is specified for both sTTI and 1 ms TTI

R1-1613402 WF on fallback operation for shortened processing time in 1ms TTI LG Electronics, Intel, Ericsson, Huawei, HiSilicon
R1-1613404 WF on UL HARQ for shortened processing time in 1ms TTI LG Electronics, Ericsson

R1-1611194 HARQ timings with 1ms TTI for FS2 Huawei, HiSilicon
R1-1611504 FS2 HARQ and UL scheduling timings for 1ms TTI and reduced processing time Ericsson
R1-1611768 Shortened processing time for FS2 in 1ms TTI LG Electronics

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R1-1612118 DL HARQ-ACK feedback for FS2 with 1-ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1612177 TDD UL scheduling timing for PUSCH on UpPTS with processing time reduction of 1ms TTI CMCC
R1-1612402 TDD DL HARQ-ACK feedback procedure for processing time reduction with 1ms TTI Samsung
R1-1612786 UL Scheduling timing for FS2 with 1-ms TTI Nokia, Alcatel-Lucent Shanghai Bell

R1-1613403 WF on UL scheduling timing for FS2 with shortened processing time in 1ms TTI LG Electronics, Intel, Ericsson, ZTE, ZTE Microelectronics, NTT DOCOMO

R1-1611503 Fast CSI for 1ms TTI Ericsson
R1-1611767 CSI feedback for 1ms TTI with shortened processing time LG Electronics
R1-1612401 CSI measurement and reporting for processing time reduction with 1ms TTI Samsung
R1-1612692 Views on CSI feedback for 1ms TTI with shortened processing time NTT DOCOMO, INC.
R1-1612931 On CSI and SRS Timing with 1-ms TTI Nokia, Alcatel-Lucent Shanghai Bell

6.2.10.2 Shortened TTI length together with shortened processing time

R1-1611529 On terminology for sTTI Ericsson

6.2.10.2.1 sTTI operation

Considering sTTI layout in UL and DL, supported combinations of sTTI lengths in UL and DL, TTI and sTTI collision, candidate UL DMRS positions in sTTI layout and related signalling

R1-1611349 Design for sTTI partition CATT
R1-1611637 sTTI operation Qualcomm Incorporated
R1-1611770 Timing of Hybrid ARQ in shortened TTI length LG Electronics
R1-1611771 Discussion on sTTI operations LG Electronics
R1-1611945 On TTI indexing for shortened TTI operation Intel Corporation
R1-1612110 Discussion on UL and DL sTTI design Panasonic
R1-1612403 Overview of sTTI operations Samsung
R1-1612693 Views on sTTI operation NTT DOCOMO, INC.
R1-1612739 Shortened TTI structure Motorola Mobility
R1-1612749 Discussions on the structure of STTI Mediatek

R1-1611154 Discussion on DL 2-symbol sTTI structure Huawei, HiSilicon
R1-1611507 On DL sTTI layout Ericsson
R1-1611769 Discussions on DL sTTI structure LG Electronics
R1-1612213 On DL subframe structure for 2OS shortened TTI Nokia, Alcatel-Lucent Shanghai Bell

R1-1611155 Discussion on UL sTTI length and structure Huawei, HiSilicon
R1-1611457 Considerations on UL DMRS indication ZTE, ZTE Microelectronics
R1-1611508 On UL sTTI layout Ericsson
R1-1612152 Simultaneous Transmissions of UL Signals for Shortened TTI Operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1612153 On sPUSCH structure and details of UL DMRS in shorter TTI Nokia, Alcatel-Lucent Shanghai Bell

R1-1613406 WF on DL sTTI pattern for 2-symbol TTI LG Electronics, Intel, KT Corporation, NTT DOCOMO
R1-1613325 Way Forward on 2os sPDSCH structure Ericsson, Huawei, HiSilicon
Revision of R1-1613395

Agreements:
- The sTTI design is not optimized for N_PRB <= 10.
- Clarification: the DL sTTI length in R1-168500 refers to the RRC configured DL sTTI length

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Proposed agreement:
For 2-symbol DL sTTI, the option 1-1 is supported.
Supported by: LG Electronics, Intel, KT Corporation, NTT DOCOMO, Samsung, Sharp (6)
For 2-symbol DL sTTI, the option 2-1 is supported.
Supported by: Ericsson, Huawei, HiSilicon, Nokia, ASB, Qualcomm, CATT (7)

Agreement:
For 2-symbol DL sTTI, consider further only options 1-1 and 2-1

R1-1613396 Way Forward on 2os sPUSCH structure Ericsson, Huawei, HiSilicon

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R1-1613695 WF on sPUSCH structure for 2-symbol TTI LG Electronics, Nokia, ASB, Huawei, HiSilicon, Ericsson, Motorola Mobility, Samsung, CATT, Qualcomm, Intel, NTT DOCOMO
Not supported by: Nokia and ASB
Supported by: Vodafone, ZTE, ZTE Microelectronics

R1-1613738 WF on sPUSCH structure for 2-symbol TTI LG Electronics, Nokia, ASB, Huawei, HiSilicon, Ericsson, Motorola Mobility, Samsung, CATT, Qualcomm, NTT DOCOMO, ZTE, ZTE Microelectronics

R1-1613691 Way Forward on 2-symbols DL sTTI layout structure Intel, Ericsson, CATT, Nokia, Alcatel-Lucent Shanghai Bell, Huawei, HiSilicon, NTT DoCoMo, Samsung, Qualcomm, Vodafone

R1-1613329 WF on a correction to the UL TTI patterns for slot TTI
Ericsson, LG Electronics, Huawei, HiSilicon, Motorola Mobility, Nokia, ASB, Mediatek, CATT, NTT DOCOMO, Qualcomm

R1-1611456 Considerations on sTTI length ZTE, ZTE Microelectronics
R1-1611509 On supported sTTI combinations Ericsson
R1-1611510 sTTI lengths combination in case of CA Ericsson
R1-1612150 Considerations of (s)TTI Length Combinations for DL and ULNokia, Alcatel-Lucent Shanghai Bell
R1-1612194 Discussion on CA system supporting sTTI operation ITRI

R1-1613327 WF on DL sTTI length configuration LG Electronics, Ericsson, Samsung, Huawei, HiSilicon, NTT DOCOMO, Qualcomm, Intel, Nokia, ASB, ZTE, ZTE Microelectronics, CATT, MediaTek
Revision of R1-1613405
Agreement:
- For a given UE, the same DL sTTI length is configured for the serving cells within the same PUCCH group for which sTTI operation is configured
  - FFS on across two PUCCH groups

R1-1613374 WF on the combination of DL and UL sTTI length Huawei, HiSilicon, LGE, ZTE, ZTE Microelectronics
Supported also by: NTT DOCOMO
Proposal:
- Alt.4 is supported for sTTI WI
  - i.e, UE supports the {DL, UL} sTTI length combination of {2,2}, {2,4}, {2,7}, {7,7}

R1-1613549 WF on the Combination of DL-UL sTTI lengths Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Mediatek, Intel

Agreement:
- For a user capable of supporting sTTI, the following {DL,UL} configurations are supported:
  - {2,2} and {7,7}
  - Working assumption on support of {2,7}.
    - The working assumption is to be confirmed in RAN1 #88 if no significant issues (including no obvious performance gain) are identified.

Proposed agreement:
- For a user capable of supporting sTTI, the following {DL,UL} configurations are not supported:
  - {7, 14}
  - {2, 14}
  - {2, 4}

R1-1611163 Handling collision between sPDSCH/sPUSCH and PDSCH/PUSCH Huawei, HiSilicon
R1-1611468 Simultaneous transmission and reception in sTTI ZTE, ZTE Microelectronics
R1-1611350 Discussion on multiplexing of normal TTI and sTTI CATT
R1-1611514 Handling overlapping allocations with short and 1 ms TTI Ericsson
R1-1611515 Puncturing sTTI in legacy TTI Ericsson
R1-1611532 HARQ process operation with Legacy TTIs, Reduced Processing, and sTTIs Ericsson
R1-1611772 Discussion on collisions between TTI and sTTI LG Electronics

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R1-1612208 On simultaneous unicast PDSCH and sPDSCH operation Nokia, Alcatel-Lucent Shanghai Bell
Agreement:
Revised agreement from RAN1 #84bis according to the below (revisions are marked in red)

- A UE is expected to handle the following cases in the same carrier in a subframe
  - Receiving legacy TTI non-unicast PDSCH (except FFS for SC-PTM) and short TTI unicast PDSCH(s)
  - Receiving legacy TTI non-unicast PDSCH (except FFS for SC-PTM) and legacy TTI unicast PDSCH~~(s)~~

R1-1612405 Coexistence between legacy TTI and sTTI operations for DL/UL Samsung
R1-1612740 Multiplexing of regular TTI and shortened TTI Motorola Mobility

R1-1613324 Way Forward on handling of PDSCH/sPDSCH assignments for the same subframe and carrier Ericsson, LG Electronics, Huawei, HiSilicon, Nokia, ASB, ZTE, ZTE Microelectronic, Intel, NTT DOCOMO, Qualcomm
Revision of R1-1613397

Agreements:

- A UE can be dynamically (with a subframe to subframe granularity) scheduled with legacy TTI unicast PDSCH and/or short TTI unicast PDSCH

~~•~~ If the UE is indicating the capability of decoding PDSCH and sPDSCH assigned with C-RNTI/SPS C-RNTI in the same subframe for a given carrier
  ~~o~~ If valid DL assignments are detected based on C-RNTI/SPS C-RNTI in PDCCH/EPDCCH for PDSCH and PDCCH/sPDCCH for sPDSCH in the same subframe for a given carrier, the UE should decode the PDSCH in addition to sPDSCH
    ~~•~~ UE shall provide HARQ-ACK feedback for both PDSCH and sPDSCH
    ~~•~~ No special consideration is specified for overlapping of sPDSCH and PDSCH
~~•~~ Otherwise
  ~~o~~ If valid DL assignments are detected based on C-RNTI/SPS C-RNTI in PDCCH/EPDCCH for PDSCH and PDCCH/sPDCCH for sPDSCH in the same subframe for a given carrier, the UE should decode the sPDSCH and is not required to decode PDSCH
    ~~•~~ UE shall provide HARQ-ACK feedback for both PDSCH and sPDSCH

R1-1613407 WF on handling PUSCH and sPUSCH for a UE in the same subframe on a given carrier LG Electronics, Ericsson

R1-1612404 TDD-specific issues on sTTI operation Samsung
R1-1612151 Considerations of slot-level sTTI for FS2 Nokia, Alcatel-Lucent Shanghai Bell

6.2.10.2.2 DL control channel design

(s)DCI message handling and physical layer design of sPDCCH design

R1-1613028 Discussion on sTTI scheduling schemes Huawei, HiSilicon
Revision of R1-1611158
R1-1611511 On sTTI scheduling options Ericsson
R1-1611351 On sDCI design CATT
R1-1611353 Other issues for sPDCCH design CATT
R1-1611469 Discussion on sPDCCH for sTTI ZTE, ZTE Microelectronics
R1-1611547 Discussion on sPDCCH for shortened TTI Sony
R1-1611638 Downlink Control Channel Design for Shortened TTI Qualcomm Incorporated
R1-1611773 Discussions on sPDCCH design LG Electronics
R1-1611946 DCI formats for shorten TTI Intel Corporation
R1-1612109 Discussion on single level DCI and two-level DCI Panasonic
R1-1612115 Discussion on the sTTI scheduling schemes Beijing Xiaomi Mobile Software
R1-1612210 On two-level DL control channel design for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1612406 sDCI for sTTI operation Samsung
R1-1612694 s(E)PDCCH for shortened TTI NTT DOCOMO, INC.
R1-1612741 Control signalling for shortened TTI Motorola Mobility
R1-1612759 sPDCCH design for short TTI HTC Corporation

R1-1613422 WF on support of single-level DCI for sTTI scheduling Samsung
R1-1613373 WF on sTTI scheduling Huawei, HiSilicon

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Email discussion until 18th Jan. of sTTI scheduling (e.g., R1-1613373 and R1-1613422) – Xia Yuan (Huawei)

R1-1613329 WF on PDCCH carrying sDCI LG Electronics, Ericsson, Intel, Huawei, HiSilicon
Revision of R1-1613408

R1-1611156 Discussion on CRS based sPDCCH Huawei, HiSilicon
R1-1611157 Discussion on DMRS-based sPDCCH Huawei, HiSilico R1-1613028
R1-1611512 Design aspects of sPDCCH Ericsson
R1-1611513 sPDCCH search space design Ericsson
R1-1611352 Design of sPDCCH structure CATT
R1-1611947 On sPDCCH design for shoten TTI Intel Corporation
R1-1612209 On DL control channel design for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1612211 On design of search space for short PDCCH Nokia, Alcatel-Lucent Shanghai Bell
R1-1612407 sPDCCH for 2-symbol sTTI Samsung
R1-1612408 sPDCCH for 1-slot sTTI Samsung

R1-1613409 WF on sREG and sCCE structure LG Electronics, Huawei, HiSilicon
R1-1613385 WF on number of OFDM symbol(s) for CRS based sPDCCH Huawei, HiSilicon, Ericsson, NTT DOCOMO, LG Electronics, Intel
R1-1613386 WF on number of OFDM symbol(s) for DMRS based sPDCCH Huawei, HiSilicon, Ericsson, NTT DOCOMO, Intel

6.2.10.2.3 UL control channel design

Design of UCI on sPUCCH and sPUSCH

R1-1611160 Discussion on sPUCCH design Huawei, HiSilicon
R1-1611164 Handling collision between PUCCH and sPUCCH Huawei, HiSilicon
R1-1611354 sPUCCH design for sTTI CATT
R1-1611356 UCI transmission for sTTI CATT
R1-1611470 Discussion on sPUCCH design for sTTI ZTE, ZTE Microelectronics
R1-1611517 Design aspects of sPUCCH Ericsson
R1-1611518 sPUCCH resource management Ericsson
R1-1611639 Uplink Control Channel Design for Shortened TTI Qualcomm Incorporated
R1-1611774 Channel selection sPUCCH for HARQ-ACK in shortened TTI length LG Electronics
R1-1611775 Design of sPUCCH for CSI in shortened TTI length LG Electronics
R1-1612154 sPUCCH Design for shortened TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1612374 sTTI layout for 2-symbol sPUCCH Nokia, Alcatel-Lucent Shanghai Bell
R1-1612409 sPUCCH for 2-symbol, 4-symbol, 1-slot sTTI Samsung
R1-1612695 sPUCCH for shortened TTI NTT DOCOMO, INC.

R1-1613688 WF on sPUCCH sTTI mapping Ericsson, LG Electronics, Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, NTT DOCOMO, CATT, ZTE, ZTE Microelectronics, Intel, Qualcomm, MediaTek
Revision of R1-1613326

R1-1613683 WF on sPUCCH formats Huawei, HiSilicon, Nokia, ASB, Samsung, CATT, Ericsson, LG Electronics, NTT DOCOMO, Qualcomm
Revision of R1-1613376

Agreements:

- At least the following formats should be designed for sPUCCH:
  - For sPUCCH supporting up to 2-bit HARQ-ACK and/or SR (if any)
    - DMRS based demodulation for 7-symbol sTTI
    - FFS on the formats and DMRS design for 2-symbol sTTI
  - For sPUCCH supporting more than 2-bit HARQ-ACK and SR (if any)
    - DMRS based demodulation for all sTTI lengths
- FFS on encoding methods
- FFS on sPUCCH with channel selection for up to 4-bit HARQ-ACK.
- FFS on support of frequency hopping

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R1-1613415 WF on sPUCCH formats for different sTTI lengths Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, LG Electronics, ZTE, ZTE Microelectronics
R1-1613410 WF on coding for sPUCCH LG Electronics, Huawei, HiSilicon, Ericsson

R1-1613378 WF on intra-sTTI frequency hopping of sPUCCH Huawei, HiSilicon. CATT
R1-1613379 WF on PUCCH resource allocation Huawei, HiSilicon

R1-1611355 Discussion on the simultaneous transmissions of (s)PUCCH and (s)PUSCH CATT
R1-1612828 Handling collision between sPUCCH/PUCCH and PUSCH/sPUSCH Huawei, HiSilicon

R1-1613387 WF on handling of sPUCCH and sPUSCH Huawei, HiSilicon, Ericsson, LG Electronics

R1-1611162 sUCI on sPUSCH Huawei, HiSilicon
R1-1611776 Discussion on UCI on sPUSCH LG Electronics
R1-1613393 UCI on sPUSCH with short TTI Ericsson
Revision of R1-1611516

R1-1611524 sPUCCH power control Ericsson

6.2.10.2.4 DL data channel design

sPDSCH design and DMRS design

R1-1611159 Discussion on DL RS for short TTI Huawei, HiSilicon
R1-1611357 Discussion on DMRS design for DL sTTI CATT
R1-1611471 Study on sPDSCH transmission in sTTI ZTE, ZTE Microelectronics
R1-1611519 DL DMRS design for 2 OS sTTI Ericsson
R1-1611520 DL DMRS design for slot sTTI Ericsson
R1-1611521 Design aspects of sPDSCH Ericsson
R1-1611640 Downlink Data Channel Design for Shortened TTI Qualcomm Incorporated
R1-1611777 Discussions on sPDSCH and DMRS design LG Electronics
R1-1611877 TBS determination for short TTI Huawei, HiSilicon
R1-1612212 On details of flexible DMRS design for 2-symbol DL shorter TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-1612410 sPDSCH for 2-symbol/1-slot sTTI Samsung
R1-1612696 sPDSCH for shortened TTI NTT DOCOMO, INC.
R1-1612742 PDSCH for shortened TTI Motorola Mobility
R1-1612748 DL DMRS design for shortened TTI Mediatek

6.2.10.2.5 UL data channel design

sPUSCH design and DMRS design to support multiplexing

R1-1611165 Discussion on UL RS for short TTI Huawei, HiSilicon
R1-1611358 Discussion on DMRS design for sPUSCH CATT
R1-1611472 Study on sPUSCH transmission in sTTI ZTE, ZTE Microelectronics
R1-1611522 Design aspects of sPUSCH Ericsson
R1-1611527 Asynchronous HARQ for UL retransmissions with short TTI Ericsson
R1-1611641 Uplink Data Channel Design for Shortened TTI Qualcomm Incorporated
R1-1611778 Discussion on sPUSCH and DM-RS designs for sTTI LG Electronics
R1-1611948 UL design aspects of TTI shortening Intel Corporation
R1-1612108 UL simultaneous transmission between sTTI and TTI Panasonic
R1-1612411 sPUSCH for 2-symbol, 4-symbol, 1-slot sTTI Samsung
R1-1612697 sPUSCH for shortened TTI NTT DOCOMO, INC.
R1-1612935 sPUSCH design with 2-symbol, 4-symbol, 1-slot sTTI KT Corp.

R1-1611523 sPUSCH power control and PHR report for sTTI Ericsson
R1-1611161 UL power control for short TTI Huawei, HiSilicon
R1-1611530 Possible RF impacts related to sPUSCH design Ericsson
R1-1613689 [Draft LS] On possible RF impacts related to sPUSCH design Ericsson
Revision of R1-1611531
Agreed in R1-1613334

R1-1613416 Draft LS on impacts of Pcmax for shortened TTI Huawei, HiSilicon

R1-1613378 WF on DMRS for sPUSCH Huawei, HiSilicon
R1-1613398 WF on a correction to the UL TTI patterns for slot and 4os TTI Ericsson, LG Electronics, Huawei, HiSilicon

6.2.10.2.6 Processing time

With focus on maximum TA and minimum data processing time

R1-1611166 Discussion on CSI feedback for short TTI Huawei, HiSilicon
R1-1611167 Processing time reduction and related procedures for short TTIHuawei, HiSilicon
R1-1611169 TDD-specific design for short TTI Huawei, HiSilicon
R1-1611359 Implicit HARQ and scheduling timing design for LTE sTTI CATT
R1-1611360 Explicit HARQ and scheduling timing design for LTE sTTI CATT
R1-1611473 Processing time reduction and related procedures ZTE, ZTE Microelectronics
R1-1613394 On reduced processing time for short TTI Ericsson
Revision of R1-1611525
R1-1611642 Processing time reduction and related procedures for DL Qualcomm Incorporated
R1-1611643 Processing time reduction and related procedures for UL Qualcomm Incorporated
R1-1611644 TDD-specific design for shortened TTI Qualcomm Incorporated
R1-1611949 On the processing time reduction for latency reduction Intel Corporation
R1-1612178 Discussion on HARQ timing for shortened TTI in TDD CMCC
R1-1612412 Processing time reduction for sTTI operation Samsung
R1-1612618 Association timing for sTTI with different UL and DL lengths Sharp
R1-1612619 Processing time reduction for TDD with 1-slot sTTI Sharp
R1-1612698 Views on processing time reduction and related procedures NTT DOCOMO, INC.
R1-1612699 Views on CSI feedback for shortened TTI with reduced processing time NTT DOCOMO, INC.
R1-1612766 On TA limitation concerning processing time reduction SoftBank Corp.

6.2.10.2.7 Others

R1-1611193 Discussion on CA issues for shortened TTI operation Huawei, HiSilicon
R1-1611526 FS2 aspects of short TTI Ericsson
R1-1611528 TBS scaling for short TTI Ericsson
R1-1611645 Link evaluation of DL data transmission under symbol-dependent impact Qualcomm Incorporated
R1-1612195 Power headroom reporting issue for sTTI operation ITRI
R1-1612743 CSI aspects of shortened TTI Motorola Mobility

6.2.11 Performance enhancements for high speed scenario - *WID in RP-152263.*

R1-1613707 Chairman's notes of AI 6.2.11 on Performance enhancements for high speed scenario Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed with following updates

R1-1612301 Introduction of performance enhancements for high speed scenario Ericsson LM
The CR is agreed in R1-1613067
- Note: the selection of PRACH resources are to be added once RAN2 CRs are available
- Note: also need to update the number of preambles per cell as in the 2nd paragraph of the CR

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6.2.12 Voice and Video enhancement for LTE - *WID in RP-161856*

VoLTE coverage enhancement

R1-1613708 Chairman's Notes of Agenda Item 6.2.12 Voice and Video enhancement for LTE Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

R1-1611950 On coverage and quality enhancements for VoLTE Intel Corporation
R1-1611106 PUSCH coverage enhancement for VoLTE Ericsson
R1-1611170 Remaining issues on VoLTE coverage enhancement Huawei, HiSilicon

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R1-1612099 Remaining issues of VoLTE/ViLTE coverage enhancements China Telecommunications
R1-1611442 Further details on PUSCH enhancement for VoLTE Nokia, Alcatel-Lucent Shanghai Bell

R1-1611646 Coverage enhancement techniques Qualcomm Incorporated

Agreement:

- When configured in the new PUSCH enhancement mode, in the common search space the UE monitors DCI0 (without HARQ process ID) and DCI1A. These two grants have the same size.

R1-1613675 WF on bandwidth for VoLTE and ViLTE enhancement CMCC, Huawei, HiSilicon, Qualcomm, China Telecom
R1-1613671 WF on eVoLTE Huawei, HiSilicon, Ericsson, QualComm

Agreements:

- Support maximum PUSCH bandwidth of 20MHz for the new PUSCH enhancement mode
- The maximum number of repetitions for PUSCH in the new PUSCH enhancement mode is 32
- Number of PUSCH repetitions in the new PUSCH enhancement mode:
  - Number of repetitions {1, 2, 4, 8, 12, 16, 24, 32} indicated by a 3-bit DCI field
  - 12 and 24 are new values compared to Rel-13 CE mode A, as agreed for FeMTC
- The TBS restriction of CE Mode A does not apply in the new PUSCH enhancement mode
- UE is RRC reconfigured to switch between normal mode and the new PUSCH enhancement mode
- Reuse the resource assignment field of DCI Format 0 for the new PUSCH enhancement mode

Email approval of RRC parameter lists until 1st Dec. - Yu Bo (Huawei)

6.2.13 Study on Further enhancements to Coordinated Multi-Point Operation

SID in RP-160954

R1-1613709 Chairman's notes of AI 6.2.13 on Study on Further enhancements to Coordinated Multi-Point Operation Ad-Hoc chair (Intel)
Contents incorporated below
Endorsed

R1-1611437 TP on TR 36 741 Study on FeCoMP ZTE, ZTE Microelectronics
R1-1613534 TP on capturing the results to TR 36 741 Study on FeCoMP ZTE, ZTE Microelectronics

Agreements:

- Endorse TP in R1-1613534 without Table 7.2-7 in **R1-1613576**
- If the FTP results for that table is not available, capture full buffer results with the following note in simulation assumptions "RAN1 will not draw any conclusions on the performance gains of full buffer traffic model results"

R1-1613535 TP on potential enhancement for TR 36 741 Study on FeCoMP ZTE, ZTE Microelectronics

Agreements:

- Endorse TP in R1-1613535

Conclusion:

- The companies are encouraged to provide details of the potential enhancements for NC-JT and CS/CB schemes to be captured in the TR 36.741

6.2.13.1 Evaluation results and enhancements for non-coherent joint transmission

R1-1611177 Enhancements on control signalling for non-coherent JT Huawei, HiSilicon
R1-1611178 CSI enhancements for non-coherent JT Huawei, HiSilicon
R1-1611436 Potential enhancements and specification impact on NCJT ZTE, ZTE Microelectronics
R1-1611438 Initial evaluation results of non-coherent JT ZTE, ZTE Microelectronics
R1-1611441 QCL Issues of Joint Transmission ZTE, ASTRI
Updated to R1-1613536 QCL Issues of Joint Transmission ZTE, ASTRI
R1-1611647 Enhancements for non-coherent JT Qualcomm Incorporated
R1-1611886 Simulation results of non-coherent JT Huawei, HiSilicon
R1-1611951 Evaluation results of NC-JT for FeCoMP in indoor scenario Intel Corporation
R1-1611952 Evaluation results of NC-JT for FeCoMP in heterogeneous scenario Intel Corporation

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R1-1611953 Evaluation results of NC-JT for FeCoMP in homogenous scenario Intel Corporation
R1-1611954 Specification impact for NC-JT Intel Corporation
R1-1612114 System level performance for non-coherent JT Nokia
R1-1612413 Enhancements for non-coherent JT Samsung

6.2.13.2 *Evaluation results and enhancements for coordinated scheduling/beamforming with FD-MIMO*

R1-1611179 CSI enhancements for CS/CB with FD-MIMO Huawei, HiSilicon
R1-1611180 Discussion on CS/CB enhancements with non-ideal backhaul links Huawei, HiSilicon
R1-1611439 Potential enhancements and specification impact on CS/CB ZTE, ZTE Microelectronics
R1-1611440 Evaluation results for CSCB ZTE, ZTE Microelectronics
R1-1611648 Enhancements for coordinated scheduling/beamforming with FD-MIMO Qualcomm Incorporated
R1-1611887 Simulation results of CS/CB with FD-MIMO Huawei, HiSilicon
R1-1611955 Evaluation results of CS/CB CoMP with FD-MIMO Intel Corporation
R1-1611956 Specification impact of CS/CB CoMP with FD-MIMO Intel Corporation
R1-1612414 Evaluation results and enhancement for coordinated beamforming with FD-MIMO Samsung

7 NR

7.1 Study on New Radio Access Technology - SID in RP-161596

Additional RAN guidance is existed in RP-161914

Monday
R1-1612707 **Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.**
The document was presented by Kazuaki Takeda from NTT DOCOMO.
Discussion: Still busy updating this version 0.3.1 with comments received on email reflector (mainly from Huawei)
Decision: The document is noted. Continue offline discussion until Wednesday morning – (NTT DOCOMO)
Thursday
R1-1613170 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
Decision: The document (version 0.3.2) is noted and content is endorsed as v1.0.0 in R1-1613687. This version shall be presented for information to next plenary RAN#74.

R1-1612706 Workplan for Study on NR Access Technology NTT DOCOMO, INC.
R1-1612225 Discussion on the options in NR design Panasonic Corporation
R1-1612226 Discussion on the term "eMBB usage", "URLLC usage" and "mMTC usage" in study item Panasonic Corporation

7.1.1 Remaining issues on numerology and frame structure

R1-1612448 Handling of DC Subcarrier Samsung
R1-1612216 Remaining issues on NR frame structure ETRI
R1-1612714 Frequency-domain aspects of frame structure NTT DOCOMO, INC.
R1-1612442 Slot Length Aspects Samsung
R1-1611961 On the need for fractional PRBs in NR Intel Corporation
R1-1612446 Guard band Considering Channel Bandwidth for Mixed Numerologies Samsung
R1-1612020 Minimum system bandwidth for MMW Qualcomm Incorporated
R1-1611958 Wide bandwidth support in NR Intel Corporation
R1-1612907 On carrier bandwidth for NR Ericsson
R1-1611196 Evaluation on CP length for URLLC Huawei, HiSilicon
R1-1611287 About introduction of additional (E)CP overheads ZTE, ZTE Microelectronics
R1-1611779 Discussion on numerologies for URLLC LG Electronics
R1-1612018 Considerations on ECP use cases Qualcomm Incorporated
R1-1612017 Tone spacing and CP type for mmW Qualcomm Incorporated
R1-1611458 Proposal for supported subslot durations Fujitsu
R1-1612262 On the mini-slot structures in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612263 Comparison of slot and mini-slot based approaches for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612744 Flexible frame structure and control signalling for NR Motorola Mobility
R1-1612904 On mini-slots Ericsson
R1-1612906 On carrier aggregation Ericsson

Agreement: NR should provide support for carrier aggregation, including different carriers having same or different numerologies.

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Wednesday session

R1-1613447 WF on Fractional PRB ZTE, Samsung, Panasonic, Docomo, Deutsche Telekom, ETRI

- Fractional PRB, less than 12 subcarriers, is supported for NR at least for data
- Fractional PRB is only used when an adjacent full PRB is used with the same numerology.
- No special handling of DMRS (like DMRS location) due to the presence of fractional PRB. To use the closest RS in adjacent full PRB for demodulation should be possible.
- Fractional PRB is applied to OFDM, FFS if DFT-s-OFDM is supported
- For other topics, RAN1 shall strive for keeping the design of the fractional PRB simple and to minimize the standardization impact, e.g.:
  - Transport block size handling in the same manner as it would be done for the flexible slot/subslot length
  - Transmit power control handling in the same manner as it would be done for flexible scheduling in the number of PRBs

Discussion: several believe that this is optimization – should be postponed to the standardization phase
Decision: The document is noted.

Mini-slots

R1-1613160 WF on mini-slots ZTE, ZTE Microelectronics, Qualcomm, Ericsson, Nokia

- Mini-slots have the following properties
  - Length
    - From 1 to "slotlength-1"
    - FFS whether and how to downselect
  - Aggregation
    - FFS: Possible to aggregate several mini-slots
    - Possible to aggregate mini-slots and slot
  - Alignment
    - Mini-slots align at least on 1ms boundaries
    - FFS: the necessity to align on a smaller granularity (e.g. slot boundary)
    - When aggregated with a slot, mini-slots do not exceed slot boundaries
  - NR-PDCCH monitoring
    - Shall be possible to monitor NR-PDCCH on mini-slots boundary
    - To reduce power consumption, longer configurable monitoring intervals shall be possible

Discussion: Proposal to modify mini-slots length as "From 1 to "slotlength-1" OFDM symbols in the slot numerology"
Decision: The document is noted.

Possible agreements:

- Mini-slots have the following properties
  - Aggregation
    - FFS: Possible to aggregate several mini-slots
    - Possible to aggregate mini-slots and slot
  - Alignment
    - Mini-slots align at least on 1ms boundaries
    - FFS: the necessity to align on a smaller granularity (e.g. slot boundary)
    - When aggregated with a slot, mini-slots do not exceed slot boundaries
  - NR-PDCCH monitoring
    - Shall be possible to monitor NR-PDCCH on mini-slots boundary
    - To reduce power consumption, longer configurable monitoring intervals shall be possible

R1-1613736 Summary from offline discussion remaining issues on mini-slots ZTE
Discussion: The note "already agreed every symbol is starting symbol above 6 GHz, except URLLC" was not agreed by Huawei.
Decision: The document is noted.

R1-1613779 Summary of offline discussion about mini-slots ZTE

Agreements:

1. NR-PDCCH monitoring at least for single-stage DCI design,
   1. NR supports the following minimum granularity of the DCI monitoring occasion:
      1. For slots: once per slot
      2. When mini-slots are used: FFS if every symbol or every second symbol
         1. FFS with respect to which numerology if slot and mini-slot have different numerology (e.g. SCS, CP overhead)
         1. Note: slot/mini-slot alignment is not assumed here

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2. Note: This may not apply in all cases

Extended CP

R1-1613478 WF on extended CP Huawei, HiSilicon, CATT, Sony, Mediatek, OPPO

- *Slot boundary with different CP overhead with the same or different subcarrier spacing should be aligned at subframe boundary at least.*
- *NR should at least support 60kHz with extended CP for URLLC Service*
  - *48 FDM symbols in one subframe*
- *For eMBB service*
  - *NR should at least support 60kHz with extended CP for high speed scenarios*
  - *NR should at least support ECP for 120kHz below 40GHz band*
    - *FFS between 96 or 104 OFDM symbols in one subframe*
  - *NR should at least support ECP for 960kHz above 40GHz band*
- *For multiplexing of transmissions for eMBB/URLLC is supported by*
  - *Using different sub-carrier spacing*
    - *Both same and different CP overhead are supported*
- *For the scenario required relaxing uplink timing synchronization*
  - *Support 15/30/60kHz SCS with ECP for uplink transmission*

Decision: The document is noted. Continue offline.

R1-1613382 WF on ECP use case for 60 kHz ZTE, ZTE Microelectronics, Samsung, Qualcomm

- ***Assumptions:***
  - Multiplexing by puncturing eMBB is supported
  - URLLC transmission bursts align with eMBB symbol boundaries
- ***Proposal 1****: Use case for the extended CP*
  - *Multiplexing of eMBB and URLLC deployed below 6 GHz*
  - *SCS for eMBB 15/30 kHz, SCS for URLLC = 60 kHz*
    - *Support extended CP for URLLC = 60 kHz*
- ***Proposal 2:***
  - *Study 2 solutions to support URLLC ECP @ 60 kHz SCS*
    - *3symb-ECP symbol aligned with eMBB @15 kHz*
    - *7symb-ECP bi-symbol aligned with eMBB@15 kHz*
  - *Compare above ECP approached with scaled NCP for URLLC*

Decision: The document is noted.

Possible agreement:

- Possible use case for the extended CP
  - Multiplexing of eMBB and URLLC deployed below 6 GHz
  - SCS for eMBB 15(NCP)/30/60 kHz, SCS for URLLC = 60 kHz
- Support extended CP for 60 kHz SCC at least for URLLC

Thursday

R1-1613658 WF on extended CP Huawei, HiSilicon, CATT, Sony, Mediatek, OPPO, Vodafone, Orange, Nokia, ASB, Ericsson, ZTE

Agreements:

- Possible use cases for the extended CP include
  - Multiplexing of eMBB and URLLC deployed below 6 GHz
    - SCS for eMBB 15(NCP)/30/60kHz, SCS for URLLC = 60 kHz
  - Transmission of URLLC with 60 kHz SCS
  - High speed scenarios for 30kHz and 60kHz
- Support extended CP at least for 60 kHz SCS
  - UE support for ECP may depend on UE type/capability
  - FFS how to configure UE using different CP overhead
  - FFS the length of ECP
- FFS extended CP for other scenarios/numerologies

R1-1613364 WF on Spectrum Partitioning with Mixed Numerology AT&T, Ericsson, Huawei, HiSilicon, CATT

- UEs can be at least semi-statically configured to transmit and/or receive data with different numerologies within a cell
  - FFS: if the numerology, from a UE point-of-view can be dynamically varied
- The network can simultaneously configure different UEs within a cell with different numerologies

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- UEs configured with different numerologies may not be restricted to be scheduled in different non-overlapping parts of a carrier
  - Implying that, from a network point of view, the numerology of a certain frequency-part of a carrier can be dynamically varied
  - Does not mean that different UEs with different numerologies may be *simultaneously* scheduled in overlapping parts of a carrier
  - FFS: If spectrum confinement (filtering, windowing, …) can be dynamically varied or not
- UEs configured with different numerologies may not be restricted to be scheduled in different non-overlapping times

Decision: The document is noted. Continue offline.

Thursday

R1-1613521 WF on Spectrum Partitioning with Mixed Numerology AT&T, Ericsson, Huawei, HiSilicon, CATT, Samsung, Panasonic, National Instruments, NTT DOCOMO

Agreements:

- NR strives for efficient support of dynamic resource allocation of different numerologies in FDM/TDM fashion.
  - Potential specification impact includes but is not limited to:
    - FFS:CSI-RS measurement
  - FFS: the time and frequency granularity of dynamic resource allocation
    - FFS: If spectrum confinement (filtering, windowing, …) can be dynamically varied or not

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R1-1613161 WF on URLLC/eMBB multiplexing ZTE, ZTE Microelectronics, Qualcomm, Ericsson, Nokia, Samsung, Sharp

- Dynamic resource sharing between URLLC and eMBB is supported by
  - Puncturing eMBB symbols
  - URLLC transmission bursts align with symbol boundaries of eMBB numerology

Decision: The document is noted. Continue offline.

Thursday

R1-1613507 Multiplexing of eMBB and URLLC Samsung

R1-1613352 WF on DL dynamic resource sharing between eMBB and URLLC Huawei, HiSilicon, CATR, MediaTek, Intel

- NR should at least support orthogonal multiplexing of different DL data transmissions for dynamic resource sharing between eMBB and URLLC
  - By pre-empting part of eMBB resources and re-assigning to URLLC
  - FFS whether indication is required for informing the eMBB UEs about the resources reassigned to URLLC transmission or not
  - FFS whether and/or how to transmit suspended eMBB data

Decision: The document is noted. Continue offline.

R1-1613657 WF on Multiplexing eMBB and URLLC in DL Samsung, Huawei, HiSilicon

Also supported by ZTE, ZTE Microelectronics

Possible agreements:

- NR supports URLLC transmission by preemption on eMBB transmission resources.
  - Support indication of preempted or impacted eMBB resources to respective eMBB UE(s)
  - FFS: Indication can be implicit/explicit
- Study how to handle preempted/impacted eMBB data by URLLC
  - HARQ retransmission with indication to eMBB UE of symbols and/or PRBs of the previous transmission for the same HARQ process that were preempted/impacted by the URLLC transmission
  - Transmission of eMBB data preempted or retransmission of eMBB data impacted by the URLLC UE without HARQ-ACK feedback for previous transmission of eMBB data

Friday

Email discussion until Dec.8th to list the potential solution – (Samsung)

R1-1613099 WF on the terminology of NR Panasonic, Fujitsu, CATT, OPPO

- To replace "mini-slot" by "subslot".
  - For the time being, both terms can be used.
  - Need to be clarified whether "minimum scheduling unit" means minimum periodicity of control and/or minimum duration of data allocation.
- Resource defined by one subcarrier and one symbol is called as resource element (RE).

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- "RE" should be always capitalized expression.
- RAN1 assumes frame length is 10 msec. To be confirmed by RAN2.
- The need of the term PRB or RB can be discussed in future. If it is used, it is two dimensions of time and frequency.
- To discuss the terminology corresponding to 12 subcarrier of the frequency domain only.
  - subcarrier group
  - subcarrier set
  - subcarrier unit

Decision: The document is noted. Continue offline.

Agreements:

- Resource defined by one subcarrier and one symbol is called as resource element (RE).
  - "RE" should be always capitalized expression.
- RAN1 assumes frame length is 10 msec. To be confirmed by RAN2.

R1-1613479 WF on CA and DC Huawei, HiSilicon, NTT DoCoMo

- *For phase 1, carrier aggregation/dual connectivity operation over e.g. around 1GHz contiguous and non- contiguous spectrum from both NW and UE perspectives is supported*
  - *32 or large than 32 is considered as the baseline of the maximum number of carrier for further study*
  - *Cross-carrier scheduling and joint UCI feedback are supported*
  - *Different numerologies between different/same carrier(s) for a given UE is supported*
  - *Per-carrier TB mapping is supported*
    - *FFS TB mapping across multiple carriers*
  - *Fast carrier access for efficient CA operations and limited UE capability is for further study*
  - *A framework for UL power control mechanism for both CA and DC should be considered.*

Decision: The document is noted, modified as follows:

Agreements:

- For phase 1, carrier aggregation/dual connectivity operation within NR carriers over e.g. around 1GHz contiguous and non- contiguous spectrum from both NW and UE perspectives is supported
  - [4 - 32] should be assumed for further study of the maximum number of NR carriers
    - RAN1 will try to decide the exact number in this week
  - Cross-carrier scheduling and joint UCI feedback are supported
  - Per-carrier TB mapping is supported
    - FFS TB mapping across multiple carriers

R1-1613505 WF on URLLC/eMBB multiplexing support LG Electronics

R1-1613527 Summary of offline discussion on multiplexing of eMBB and URLLC trafficEricsson

- For DL, dynamic resource sharing between URLLC and eMBB is supported by transmitting URLLC traffic scheduled using DCI
  - URLLC transmission may occur in resources used for ongoing eMBB traffic
- Means to handle of impact to eMBB traffic discussed include (note, no agreement which to support)
  - HARQ retransmission of eMBB traffic
  - Explicit indication to eMBB UE that URLLC traffic is occuring or has occured, the eMBB UE takes this into account in the receiver
  - Blind detection in the eMBB UE that URLLC traffic is interfering
  - eMBB transmission is suspended, gNB transmits the suspended data at a later point in time
  - Outer coding
  - CB interleaving

Discussion: LGE→ concern with the statement "…used for ongoing..."
Decision: The document is noted.

Agreement:

- For DL, dynamic resource sharing between URLLC and eMBB is supported by transmitting URLLC scheduled traffic
  - URLLC transmission may occur in resources scheduled for ongoing eMBB traffic

Thursday session

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R1-1613630 **Outcome from offline discussion about mini slots ZTE, ZTE Microelectronics, Intel, Interdigital, Ericsson, Motorola, Nokia, ASB, Samsung, Panasonic, LGE, Huawei, Hi Silicon, CATT, Docomo**

- Mini-slots have the following lengths
  - At least above 6 GHz, mini-slot with length 1 symbol supported
    - FFS below 6 GHz including unlicensed band
    - FFS for URLLC use case regardless frequency band
  - FFS whether DL control can be supported within one mini-slot of length 1
  - Lengths from 2 to slot length -1
    - FFS on restrictions of mini-slot length based on restrictions on starting position
    - For URLLC, 2 is supported, FFS other values
  - Note: Some UEs targeting certain use cases may not support all mini-slot lengths and all starting positions
  - Can start at any OFDM symbol, at least above 6 GHz
    - FFS below 6 GHz including unlicensed band
    - FFS for URLLC use case regardless frequency band
  - A mini-slot contains DMRS at position(s) relative to the start of the mini-slot

Decision: The document is agreed. Also supported by Cohere.

R1-1613652 **[DRAFT] LS on subcarrier spacing and carrier frequencies Ericsson**

Decision: The document is noted and final LS is approved in R1-1613748 with the following updates

RAN1 has agreeds on a subcarrier spacing $f_c=15\cdot 2^n$ as the subcarrier spacing for NR. RAN1 has also discussed the possible values of the integer n and at RAN1~~#86~~ currently discuss ~~agreed~~ to support of at least 15, 30, 60, 120, 240, and 480 kHz while the need for smaller subcarrier spacings of e.g., 3.75 ~~and 7.5~~ kHz isare for further study according to the decision at RAN1 ~~#86RAN1 chairman minutes~~:

- *NR numerology scalability should allow at least from [3.75 kHz] to 480 kHz subcarrier spacing*
- *Necessity of support for less than 15 kHz subcarrier spacing (e.g., 3.75 kHz) should be studied*

The feasibility of a certain subcarrier spacing may depend on e.g. implementation imperfections such as phase noise at different carrier frequencies. The feasibility may also depend on the deployment scenario. RAN1 would therefore ask RAN4 for feedback which subcarrier spacings that are feasible at different carrier frequencies. ~~Furthermore, as the RAN1 specifications are carrier-frequency agnostic, it is RAN1's understanding that any limitation in the supported combinations of subcarrier spacing and carrier frequency will be captured in the RAN4 specifications.~~

RAN1 is currently studying the design and performance of phase noise tracking reference signal.

ACTION: RAN1 would like to ask RAN4 to provide feedback on feasible ~~combinations of~~ subcarrier spacings ~~and carrier frequencies~~ per frequency band

R1-1613747 WF on reserved resources Samsung, ETRI
R1-1613783 WF on reserved resources Samsung, ETRI
Also supported by Ericsson, AT&T, Nokia

Agreement: At least some reserved resources are indicated by using at least RRC signaling

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611198 Evaluation on CP types for UL transmission Huawei, HiSilicon
R1-1611199 On the maximum carrier bandwidth for supporting 1GHz contiguous spectrum Huawei, HiSilicon
R1-1611204 PRB definition in time domain Huawei, HiSilicon
R1-1611205 Discussion on TDD operation on an unpaired spectrum Huawei, HiSilicon
R1-1611233 Further consideration on the guard band for mixed numerology Huawei, HiSilicon
R1-1611285 About INI and fractional PRB ZTE, ZTE Microelectronics
R1-1611286 About Mini-slots ZTE, ZTE Microelectronics
R1-1611288 About URLLC/eMBB multiplexing ZTE, ZTE Microelectronics
R1-1611289 Implicit DC sub-carrier indication ZTE, ZTE Microelectronics
R1-1611361 Limited numerology set for NR CATT
R1-1611362 NR wider bandwidth operation up to 1GHz CATT
R1-1611363 NR extended CP length use cases CATT
R1-1611364 NR symbol alignment and operation in unlicensed spectrum CATT
R1-1611365 Configurable DL control channel monitoring for power saving and blank resource indication in NR CATT

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R1-1611366 NR Time domain slot, mini-slot and time interval CATT
R1-1611367 NR frame structure for multiplexing of URLLC and eMBB traffic CATT
R1-1611368 On-demand access for UE power saving in NR system design CATT
R1-1611459 Guard period setting in TDD based NR frame structure Fujitsu
R1-1611460 TDD frame structure with mixed numerology Fujitsu
R1-1611551 Discussion on CP overhead families for URLLC Sony
R1-1611652 On numerology determination for data channel Huawei, HiSilicon
R1-1611654 Handling of DC subcarrier in NR Huawei, HiSilicon
R1-1611655 Mechanisms of bandwidth adaptation for control and data reception in single carrier and multi-carrier cases Huawei, HiSilicon
R1-1611697 Discussion of the UE support of multiple numerologies Guangdong OPPO Mobile Telecom.
R1-1611700 eMBB data transmission to support dynamic resource sharing between eMBB and URLLC Guangdong OPPO Mobile Telecom.
R1-1611709 Multiplexing of eMBB and URLLC frame structures ZTE Corporation
R1-1611715 Remaining issues on mixed numerology in a single carrier NEC
R1-1611724 Multiplexing of transmissions with different service requirements NEC
R1-1611727 Mini-slot scheduling interval NEC
R1-1611780 Remaining Details on Frame Structure LG Electronics
R1-1611781 Discussion on Wideband Operation LG Electronics
R1-1611782 Design considerations for low latency HARQ-ACK and PUSCH transmission LG Electronics
R1-1611783 Discussion on multi-carrier operation between LTE and NR LG Electronics
R1-1611892 Discussion on frequency domain frame structure for NR Panasonic Corporation
R1-1611893 Discussion and evaluation results on fractional PRB usage Panasonic Corporation
R1-1611957 Considerations on CP type and numerology for URLLC and eMBB multiplexing Intel Corporation
R1-1611959 Slot and mini-slot multiplexing and alignment Intel Corporation
R1-1611960 NR slot definition for subcarrier spacings up to and including 60kHz Intel Corporation
R1-1611962 Transmitter side dc subcarrier handling in NR Intel Corporation
R1-1612014 Mini-slot design for URLLC Qualcomm Incorporated
R1-1612015 Mini-slot design for mmW Qualcomm Incorporated
R1-1612016 Multi-TTI and size of slot/minislot and impact to mmW Qualcomm Incorporated
R1-1612019 Scalable Numerology Control Design for NR Qualcomm Incorporated
R1-1612119 On UE-specific bandwidth adaptation for single carrier operation MediaTek Inc.
R1-1612179 Numerology and RS design for high speed train scenario CMCC
R1-1612227 Forward compatibility of unlicensed band operation Panasonic Corporation
R1-1612261 On the number of symbols in a slot and minimum transmission duration Nokia, Alcatel-Lucent Shanghai Bell
R1-1612264 On bandwidth extension solutions in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612265 Signaling for forward compatibility Nokia, Alcatel-Lucent Shanghai Bell
R1-1612266 Supported numerologies for NR Phase I Nokia, Alcatel-Lucent Shanghai Bell
R1-1612267 Intra-carrier sub-band for mixed numerology Nokia, Alcatel-Lucent Shanghai Bell
R1-1612268 Guard band arrangement supporting mixed numerology Nokia, Alcatel-Lucent Shanghai Bell
R1-1612269 On the number of symbols in slot with extended CP length Nokia, Alcatel-Lucent Shanghai Bell
R1-1612360 NR Frame Structure Design AT&T GNS Belgium SPRL
R1-1612363 Resource portioning with mixed numerology AT&T GNS Belgium SPRL
R1-1612435 Wider Bandwidth Operation: CA/DC vs. Single Carrier Samsung
R1-1612436 Wide Bandwidth Operational Aspects Samsung
R1-1612437 Carrier Aggregation Aspects Samsung
R1-1612438 Slot Aggregation Samsung
R1-1612439 Bandwidth Adaptation for UE Power Savings Samsung
R1-1612440 Indication of Reserved Resources Samsung
R1-1612441 Mini-slot Aspects Samsung
R1-1612443 Extended CP Length Aspects Samsung
R1-1612444 Symbol Alignment for Different CP Overhead Samsung
R1-1612445 Guard band Considering Inter-Numerology Interference Samsung
R1-1612447 Remaining Issues on RB Grid Samsung
R1-1612449 UE Capability to Process Multiple Numerologies Samsung
R1-1612774 On Symbol Level Alignment for Operation in Unlicensed Spectrum Ericsson
R1-1612893 MU-MIMO impact on frame structure for NR Sony
R1-1612903 On fractional RBs Ericsson
R1-1612905 On numerology Ericsson
R1-1612945 Considerations on fast access inter-site small cells in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1613020 Design considerations for supporting K1=0 or K2=0 LG Electronics Inc.
R1-1613158 WF on Spectrum Partitioning with Mixed Numerology AT&T, Ericsson
R1-1613309 Discussion and evaluation on CP length for above 6GHz Huawei, HiSilicon

R1-1613423 Evaluation on CP types for High speed Huawei, HiSilicon

7.1.2 Initial access and mobility

R1-1612228 Proposal of subcell Panasonic Corporation
The document was presented by Hidetoshi Suzuki from Panasonic and introduces subcell which is proposed as the grouping method to realize group common search space. The grouping realized by subcells can be used as 1) spatial cell split, 2) beam split, 3) frequency/numerology resource split and 4) coverage split.
Discussion: Ericsson→ first discuss separetaly and then decide whether a grouping is required.
Decision: The document is noted.

R1-1612651 Discussion on initial access based on multi-beam for NR Potevio

R1-1613538 Offline discussion summary (Day 3) of initial access for NRNTT DOCOMO
The document was presented by Kazuaki Takeda from NTT DOCOMO.
Decision: The document is noted.
R1-1613567 Additional offline discussion summary (Day 3) of initial access for NR NTT DOCOMO

7.1.2.1 Synchronization signal

R1-1611267 Issues related to NR-SS ZTE, ZTE Microelectronics
- *Proposal 1: Specify one SCS for NR-SS in a given frequency range*
- *Proposal 2: Using identical bandwidth for NR-PSS and NR-SSS.*
- *Proposal 3:*
  - *NR-SS is optimized for SS-related requirements, e.g. cell search, synchronization, cell IDs, but not for RRM measurements.*
  - *NR-SS is used for idle-mode RRM measurement if NR-SS/DMRS of NR-PBCH can also meet the requirements for idle-mode RRM measurements.*
  - *RAN1 should send LS to RAN4 to evaluate the corresponding impact if only NR-SS/DMRS of NR-PBCH is used for RRM measurement of idle mode.*

Decision: The document is noted.

R1-1612128 Performance Analysis of PSS in Initial Time-Frequency Uncertainty MediaTek Inc.
- *Observation 1: The performance of Zadoff-Chu based PSS suffers from the ambiguity image at ±2 sub-carrier spacing as evidenced by the knees at the corresponding locations in the CDF of the residual frequency error.*
- *Proposal 1: NR should study new PSS candidates that does not have the ambiguity images exhibited in the Zadoff-Chu sequence.*
- *Observation 2: The detection error rate for Zadoff-Chu based PSS decreases much more slowly as SNR increases comparing to LDPB based signal due to the dominance of the ambiguous image. The gap is 3 dB at 10% error rate and widens as SNR increases.*
- *Proposal 2: NR should study new PSS candidates that can improve the detection error rate of Zadoff-Chu based design.*
- *Observation 3: Larger initial frequency uncertainty leads to higher detection error rate due to the increase in the number of hypotheses and the chances in capturing the ambiguity image in the case of Zadoff-Chu sequence. However, the degradation doesn't increase significantly. More cost-effective components can be used in the UE if complexity is reasonably maintained.*
- *Proposal 3: NR should study new PSS candidates that can relax the initial frequency accuracy of the UE without increasing the initial acquisition complexity.*
- *Observation 4: Longer synchronization periodicity leads to higher detection error rate due to the increase in the number of hypotheses. For Zadoff-Chu sequence, longer periodicity leads to negligible performance loss, especially at high SNR, due to the dominance of errors coming from the false detection of the ambiguity image.*
- *Observation 5: For LDPB sequence which has no ambiguity image, shorter sequence length is less resilient to increased periodicity. For length-42 LDPB, the performance loss is 2 dB when the periodicity increases from 5 sub-frames to 160 sub-frames.*
- *Proposal 4: Longer PSS should be adopted for longer synchronization periodicity.*
- *Observation 5: The LDPB sequence has a 3 dB advantage over Zadoff-Chu sequence in flat fading channel at high error rate (20%). The gap is expected to widen at higher SNR as in the AWGN case.*

Decision: The document is noted.

R1-1612451 Discussion on multiplexing initial access signals Samsung

- *Observation 1: FDM of the sync signals (NR-PSS/NR-SSS/NR-PBCH) with smaller subcarrier spacing provides better CFO estimation than TDM of the sync signals with larger subcarrier spacing.*
- *Proposal 1: NR supports FDM to multiplex NR-PSS, NR-SSS and NR-PBCH in high frequency band (e.g., > 6GHz).*

Decision: The document is noted.

R1-1612721 Discussion and evaluation on NR-PSS/SSS design NTT DOCOMO, INC.

- *Observation 1: NR-PSS detection would be the most complexity centric and RAN1 should carefully design NR-PSS to achieve acceptable complexity.*
- *Observation 2: Under a certain transmission bandwidth for NR-PSS, there would be a trade-off between subcarrier spacing and sequence length in terms of detection performance in presence of frequency offset.*
- *Observation 3: It is beneficial to minimize number of hypotheses for NR-PSS/SSS detection to improve the detection performance and to minimize UE burden.*
- *Observation 4: If frequency offset compensation based on NR-PSS works well, shorter subcarrier spacing and longer sequence length can be applied to NR-SSS under the same transmission bandwidth with NR-PSS.*
- *Observation 5: Frequency offset up to 1.5 subcarrier spacing would be acceptable in terms of detection performance and computational complexity especially for PSS detection.*
- *Observation 6: Repeated NR-PSS structure based on comb mapping would be helpful to mitigate residual frequency offset after NR-PSS detection and would provide flexibility for various NR-SS design.*
- *Proposal 1: Subcarrier spacing of NR-PSS/SSS should be decided according to target frequency offset with considering detection performance and computational complexity.*
- *Proposal 2: At least one baseline sequence length is defined for each of NR-PSS/SSS and transmission bandwidth of NR-PSS/SSS is linearly scaled according to subcarrier spacing value except for some possible special cases where different (e.g., longer) sequence length design provides reasonable benefit.*
- *Proposal 3: Repeated NR-PSS structure based on comb mapping should be considered.*
- *Proposal 4: Removing local ID detection from NR-PSS detection functionalities should be considered.*
- *Proposal 5: RAN1 should consider TDM of NR-PSS/SSS/PBCH in different subframe or slot with same symbol index.*
  - *Relative resource position among NR-PSS, NR-SSS and NR-PBCH with same TRP TX beam is fixed irrespective of CP overhead.*
  - *Detailed resource mapping for this approach should be further studied with considering maximum number of beam patterns for NR-PSS/SSS/PBCH transmission within a periodicity of SS burst set.*

Decision: The document is noted.

R1-1613154 WF on Synch signal structure Qualcomm, NTT DOCOMO

- NR-PSS/SSS/PBCH are transmitted from the same set of ports/same beam
- SS-block index indicated to the UE, using E.g.
  - PBCH
  - Sync Signal
  - Other signal

Decision: The document is noted, further modified as:

- NR-PSS/SSS/PBCH can be transmitted using the same set of ports/same beam
  - FFS other cases

Possible agreement:

- NR-PSS/SSS/PBCH can be transmitted using the same set of port number[/same beam]
  - FFS: Other cases

R1-1613153 WF on numerology signal structure Qualcomm, NTT DOCOMO

- Single subcarrier spacing for PSS/SSS in a given frequency band is supported from UE perspective

Decision: The document is noted.

Agreements:

- At least for multi-beams case, at least the time index of SS-block is indicated to the UE
  - FFS: single-beam case
  - FFS: whether SS-block is transmitted by single-beam or multi-beams

Agreements:

- For initial access, UE can assume a signal corresponding to a specific subcarrier spacing of NR-PSS/SSS in a given frequency band given by specification

- FFS: Definition of frequency band
- FFS: Subcarrier spacing of NR-PSS and NR-SSS is the same or not
- FFS: CP length

Agreements:

- For RAN1 evaluation purposes, it is assumed that the SSS and PBCH (if present) ports within an SS-block are constructed with applying same or different weights on a common pool of beams
  - The common pool of beams are constructed by applying beam steering weights on physical antennas on each of a common set of TXRUs
  - *Note: SSS and PBCH may or may not share the same ports.*

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Possible agreement:

- SS burst set transmission is periodic
  - In case of "blind" initial search, UE may assume a fixed periodicity of SS burst set transmission for a given carrier frequency
  - After initial access UE may be provided with updated information regarding the SS burst set periodicity by the network

Decision: The document is noted. Continue offline discussion until Tuesday.

R1-1613155 **WF on Synch signal periodicity Qualcomm, NTT DoCoMo**

Wednesday

Agreements:

- From UE perspective, SS burst set transmission is periodic
  - At least for initial cell selection, UE may assume a default periodicity of SS burst set transmission for a given carrier frequency
    - Exact value of default periodicity of SS burst set transmission for a given carrier frequency needs to be studied
  - FFS: UE in CONNECTED or IDLE mode may be provided with updated information regarding the SS burst set periodicity of serving cell and/or neighbor cells by the network
    - FFS: Validity duration of information
    - Note: Updated periodicity may be shorter or longer than default periodicity assumed by UE
    - FFS: Note: This does not imply SS-burst set needs to be always on with the updated periodicity
    - FFS: SS burst periodicity assumed by UE if information of neighbor cells is not available
    - FFS: Consider idle mode operation performance
    - Note: Companies can also consider to support functionality related to LTE DRS and LTE IDLE mode
  - Companies are encouraged to investigate the tradeoff between network flexibility/power consumption and UE complexity/power consumption

R1-1613196 WF on NR-SS Sequence Design Samsung, NTT DOCOMO, Intel

Further revised in **R1-1613417**.

Agreements:

- For NR-PSS
  - ZC-sequence can be used as the baseline sequence for NR-PSS for study.
    - Other type of sequences are not excluded, e.g. low density power boosted sequence.
  - Study the following alternatives on the NR-PSS sequence length
    - Alt 1: using sequence whose length is longer than LTE.
      - Whether one longer sequence is used or whether the longer sequence is constructed by concatenating multiple sequences which may be same or different sequence and/or length.
    - Alt 2: using sequence whose length is shorter than LTE.
    - Alt 3: using sequence whose length is the same LTE.
  - Study the following alternatives on the sequence repetition
    - Alt 1: no repetition.
    - Alt 2: time-repetitive signal of NR-PSS across OFDM symbols
    - Alt 3: time-repetitive signal of NR-PSS within an OFDM symbol
    - Alt 4: frequency-repetitive NR-PSS sequences within an OFDM symbol (element-wise or sequence-wise).
- For NR-SSS
  - Study the following alternatives for NR-SSS sequence design:
    - Alt 1: interleaving two M-sequences without scrambling using ID in PSS (no cell ID in NR-PSS).
    - Alt 2: interleaving two M-sequences with scrambling using ID in PSS as in LTE.
    - Alt 3: a root sequence cyclically shifted in time and/or frequency domain.
      - E.g. ZC-sequence or M-sequence with cyclic shifts.

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- Alt 4: message-based transmission (CRC and/or channel coding based).
- Alt 5: element-wise multiplication of the ZC-sequence and PN-sequence with cyclic shifts.
- Other alternatives are not excluded.

- Study the following alternatives on the NR-SSS sequence length:
  - Alt 1: using sequence whose length is longer than LTE.
    - Whether one longer sequence is used or whether the longer sequence is constructed by concatenating multiple sequences which may be same or different sequence and/or length.
  - Alt 2: using the same NR-SSS sequence length as in LTE.
- Study the following alternatives on the sequence repetition/interleaving:
  - Alt 1: no repetition.
  - Alt 2: time-repetitive signal of NR-SSS within or across OFDM symbols.
  - Alt 3: frequency-repetitive sequences of NR-SSS within an OFDM symbol (element-wise or sequence-wise).
  - Alt 4: frequency interleaved sequence of NR-SSS using comb structure within a OFDM symbol.

R1-1613273 WF on Periodicity for SS Burst Set Huawei, HiSilicon, InterDigital
Continue offline discussion until Wednesday – (Huawei)

R1-1613197 WF on NR synchronization signals design NTT DOCOMO, Intel, LG Electronics, Samsung, Ericsson

Agreements:

- Companies are encouraged to propose and evaluate following design parameters of NR-PSS/SSS until next meeting
  - SS burst set periodicity
  - Subcarrier spacing
  - Sequence length
  - Sequence type
  - Number of IDs provided by NR-PSS/SSS
  - Resource mapping/multiplexing
- Following target requirements should be taken into account in NR-PSS/SSS design
  - Robustness against initial frequency offset up to 5 ppm
    - 10 ppm as optional requirement
  - Reasonable complexity for NR-PSS/SSS detection
  - Good one-shot detection probability at -6 dB received baseband SNR condition with less than 1% false alarm rate
    - Companies report detection probability, the residual timing error and frequency error
  - Good detection performance in multi-cell scenario
  - Note: for mMTC, different target requirements may be considered
- Following aspects can be considered (not an exhaustive list)
  - Low system overhead due to NR-PSS/SSS transmission
  - Low PAPR of waveform for possible power boosting transmission
  - Multiplexing with other signal/channel for efficient operation
  - Utility of NR-PSS/SSS as reference signal for other channels, e.g., PBCH

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The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611261	NR primary and secondary synchronization signal design	Huawei, HiSilicon
R1-1611268	Considerations on SS block design	ZTE, ZTE Microelectronics
R1-1611269	Considerations on SS burst design	ZTE, ZTE Microelectronics
R1-1611270	Channel raster issue in NR	ZTE, ZTE Microelectronics
R1-1611369	NR Numerology Agnostic Synchronization Channel Design	CATT
R1-1611370	NR System Bandwidth Agnostic Synchronization Channel Design	CATT
R1-1611479	Beam-based timing mechanism for multi-beam cases	Spreadtrum Communications
R1-1611550	On subcarrier spacings for NR synchronization signal	Sony
R1-1611552	Consideration on NR synchronization signal design	Sony
R1-1611685	NR primary synchronization signal with X-time repetition for different frequency ranges	Huawei, HiSilicon
R1-1611693	Frequency location of the synchronization signals	Huawei, HiSilicon
R1-1611701	Discussion on multi-beam based initial access for NR	Guangdong OPPO Mobile Telecom.

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R1-1611714 Design for beamformed synchronization signals NEC
R1-1611725 Mapping of synchronization signalsNEC
R1-1611784 NR Synchronization Signal Design LG Electronics
R1-1611785 Discussion on Initial Blind Acquisition LG Electronics
R1-1611862 Structure of DL sync signal for multi-beam based approaches KT Corp.
R1-1611897 NR Synchronization signal design Ericsson
R1-1611898 NR Synchronization signal evaluations Ericsson
R1-1611899 NR Synchronization signal frequency raster Ericsson
R1-1611900 Long Network DTX in NR Ericsson
R1-1611963 Considerations for Synchronization Signal Design Intel Corporation
R1-1611965 Frequency Raster of SS Intel Corporation
R1-1611966 PSS Design for Above 6GHz Intel Corporation
R1-1612024 Multi-beam SYNC design Qualcomm Incorporated
R1-1612025 Multi-beam SYNC evaluation Qualcomm Incorporated
R1-1612026 Multiplexing of waveforms for sync Qualcomm Incorporated
R1-1612127 Link Level Simulation Results for NR Initial Synchronization above 6 GHz with Updated Evaluation Assumptions MediaTek Inc.
R1-1612180 Beam sweeping based on multi-beam-width CMCC
R1-1612217 Design of synchronization signal and broadcast channel ETRI
R1-1612379 NR PSS Design Considerations Sierra Wireless, S.A.
R1-1612450 Discussion on SS block/bust/burst set for the multi-beam case Samsung
R1-1612452 NR synchronization signal sequence Samsung
R1-1612453 Carrier raster and synchronization signal transmissionSamsung
R1-1612454 Numerology for NR synchronization signal Samsung
R1-1612455 Initial access signal mapping and multiplexing for sub6GHz Samsung
R1-1612620 Subcarrier spacing of DL synchronization signal and broadcast channel in NR Sharp
R1-1612621 DL synchronization signal structure in NR Sharp
R1-1612627 Considerations for Initial Synchronization in NR InterDigital Communications
R1-1612745 Design and evaluation of wideband synchronization signal Motorola Mobility
R1-1612755 Discussion on the design for synchronization signal Shenzhen Coolpad Technologies
R1-1612799 Open Items in Synchronization Signal Design Nokia, Alcatel-Lucent Shanghai Bell
R1-1612800 Numerology for NR Synchronization Signals Nokia, Alcatel-Lucent Shanghai Bell
R1-1612802 On synchronization signal frequency raster Nokia, Alcatel-Lucent Shanghai Bell
R1-1612803 Synchronization signal structure Nokia, Alcatel-Lucent Shanghai Bell
R1-1612804 On NR synchronization signal periodicity Nokia, Alcatel-Lucent Shanghai Bell
R1-1612805 NR synchronization signal performance Nokia, Alcatel-Lucent Shanghai Bell
R1-1612806 Providing Synchronization in CA Nokia, Alcatel-Lucent Shanghai Bell
R1-1612901 Synchronization in NR considering beam sweeping ASUSTEK COMPUTER (SHANGHAI)
R1-1613007 Synchronization Signal Burst Design for Initial Access Convida Wireless LLC
R1-1613046 Multiplexing of PSS and SSS in above 6GHz Intel Corporation
R1-1613057 SYNC raster consideration below 6GHz Qualcomm Incorporated
R1-1613058 SYNC numerology consideration below 6GHz Qualcomm Incorporated
R1-1613197 WF on NR synchronization signals design NTT DOCOMO
R1-1613273 Wayforward on Periodicity for SS Burst Set Huawei, HiSilicon
R1-1613354 WF on Synchronization Raster Qualcomm
R1-1613417 WF on NR-SS Sequence design Samsung

7.1.2.2 Broadcast signal/channel

R1-1612807 PBCH design Nokia, Alcatel-Lucent Shanghai Bell

- *Proposal 1: 2-port SFBC as baseline for NR-PBCH transmission method.*
- *Observation 1: TDM between NR synchronization signals and NR-PBCH is needed for 5 MHz transmission bandwidth option.*
- *Proposal 2: Support TDM between NR synchronization signals and NR-PBCH for 5 MHz minimum transmission bandwidth option.*
- *Observation 2: 2 symbol allocation provides around 2 dB better demodulation performance but increases SS block size by 50 %.*
- *Proposal 3: Support FDM multiplexing between synchronization signals and PBCH for 80 MHz minimum transmission bandwidth option.*
- *Proposal 4: Support FDM multiplexing beam reference signals in the same symbol with SS block.*
- *Proposal 5: Support number of BRS antenna ports at least up to 8 within an SS block.*
- *Proposal 6: SS block should support transmitting from more than two beams at a time.*

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- *Proposal 7: Study enabling UE to combine NR-PBCHs transmitted in different SS blocks within the same and in different SS burst within an NR-PBCH transmission interval.*

Decision: The document is noted.

R1-1612028 **Multi-beam PBCH design** **Qualcomm Incorporated**

- *Shortest periodicity for PBCH transmission is every SS block of a burst every 5ms.*
- *However, this high periodicity is not needed in all scenarios. Hence, the BS may not transmit PBCH in some SS blocks and instead transmit MRS.*
- *Two PBCH OFDM symbols sandwiching PSS/SSS are proposed that permit finer CFO estimation.*
- *SSS can be repurposed to form reference for PBCH for upto 2 ports. PBCH transmission scheme is FFS.*
- *SS block index is conveyed in PBCH while still permitting the UE to easily combine PBCH from different SS blocks*
- *Option 2 (NR-PBCH carries minimum information necessary for UE to perform initial UL transmission (not limited to NR-PRACH)) regarding PBCH content is realizable. Moreover, due to high available periodicity of PBCH, the essential information can be split over two messages.*

Decision: The document is noted.

R1-1612630 **Performance Evaluation for Beam Centric Design for Broadcast Channel** **InterDigital Communications**

- *Observation 1: SINR can be improved when some allowable beams are turned off during beam sweep processing.*
- *Observation 2: Higher SINR improvement is achieveable for small UE population than large UE population since more allowable beams may be turned off in case of small UE population.*
- *Observation 3: Higher SINR improvement is obtainable for non-uniform UE distribution than uniform UE distribution since more allowable beams may be turned off in case of non-uniform UE distribution.*
- *Observation 4: More interfering TRPs can be reduced for non-uniform UE distribution than uniform UE distribution since more allowable TRP beams may be turned off in case of non-uniform UE distribution, particularly the higher percentage of interfering TRPs can be significant reduced when UE population is large.*
- *Proposal 1: PBCH transmission based on all or a subset of beams in a beam sweep should be considered.*
- *Proposal 2: Association of SYNC and PBCH should be considered to reduce the beam sweep overhead in NR.*

Decision: The document is noted.

Wednesday session

R1-1613271 **WF on Multi-Beam Paging** **Huawei, HiSilicon, Samsung, MediaTek**

Also supported by LG Electronics

Agreements:

- For paging in multi-beam operation, support beam sweeping for paging, and study the following methods:
  - Alt-1: Multiplexing paging with SS blocks
    - FFS: Details of paging
  - Alt-2: Adding another round of beam sweeping for paging
    - Note: Another round of beam sweeping is different from the beam sweeping of SS burst set
  - Other alternatives are not precluded
  - Companies report their assumption for paging

R1-1613480 **WF on NR-PBCH evaluation** **NTT DOCOMO**

Agreements:

- Companies are encouraged to report, propose and evaluate following design parameters of NR-PBCH until next meeting
  - Payload size
  - Overhead of PBCH including dedicated DMRS (time/frequency/port resource amount)
  - RS for demodulation, e.g., NR-PSS, NR-SSS or dedicated DMRS or mobility RS
  - Transmission scheme, e.g., MCS, transmit diversity
  - Periodicity
  - Resource mapping/multiplexing within SS block(s)
- Companies are encouraged to report their own evaluation assumptions
- Following target requirements should be taken into account in the NR-PBCH design
  - Detectable at low received baseband SNR condition such as [-6] dB
    - Note: it does not mean NR-PBCH should be detectable by one-shot
    - Companies report the BLER used, timing assumption used and frequency offset used.
- Following can be considered for study purpose, e.g.,
  - Combining NR-PBCH across SS blocks within X ms
    - FFS: Value of X ms
  - Use of PBCH for frequency offset estimation and necessity of use of the PBCH for frequency offset estimation is also a part of the study

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Thursday session

R1-1613591 **WF on System Information Delivery** **LG Electronics, NTT DOCOMO, Inter Digital, Qualcomm,**

Agreements:

- For study of the cases where NR-PBCH carries a part of minimum system information, consider the following alternatives (or combinations) for the minimum system information other than those included in NR-PBCH :
  - Alt. 1: NR defines the additional channel as secondary broadcast channel
    - Secondary broadcast channel may be different design from NR-PBCH, e.g. payload size, resource mapping, periodicity and etc.
    - FFS on transmission: beam-specific, cell-specific, and/or TRP-specific, etc.
  - Alt. 2: The remaining information is transmitted in shared downlink channel similar to ,e.g. NR-PDSCH
    - FFS on transmission: UE-specific, UE group-specific, beam-specific, cell-specific, and/or TRP-specific, etc.
- Note: This does not preclude defining of other mechanisms transmitting Other SI

R1-1613590 **WF on further clarifications on NR-PBCH** **LG Electronics, SONY, InterDigital**

Agreements:

- Consider followings for minimum system information transmission:
  - NR-PBCH is a non-scheduled broadcast channel carrying at least a part of minimum system information with fixed payload size and periodicity predefined in the specification depending on carrier frequency range
  - Alt. 1: NR-PBCH carries a part of minimum system information
    - Alt 1-1 : remaining minimum system information is transmitted via other channel at least partially indicated by NR-PBCH
    - Alt 1-2: Remaining minimum system information is transmitted via other channel not indicated in NR-PBCH
  - Alt. 2: NR-PBCH carries all of minimum system information
- Study further NR-PBCH design examples with the following clarification of the agreements
  - Example 1 for Alt. 1-1: NR-PBCH carries a part of minimum system information including information necessary for the UE to receive channel carrying remaining minimum system information
  - Example 2 for Alt. 1-1: NR-PBCH carries information necessary for the UE to perform initial UL transmission (not limited to NR-PRACH, e.g. PRACH msg. 1) and possibly information necessary to receive the response to initial UL transmission (e.g., PRACH msg. 2) in addition to information in Example 1
  - Example 3 for Alt. 2: NR-PBCH carries all minimum system information
  - Example 4 for Alt. 1-2: NR-PBCH carries information necessary for the UE to perform initial UL transmission (not limited to NR-PRACH, e.g. PRACH msg. 1) and information necessary to receive the response to initial UL transmission (e.g. PRACH msg. 2)
    - Information necessary to receive remaining minimum system information is provided after initial UL transmission
  - Other examples are not precluded
  - Prepare draft LS to RAN2 to clarify the contents and RAN2 preferred size of minimum system information and whether it can be delivered by on demand – Eunsun (LG)

R1-1613686 **draft LS on minimum system information LG**

Agreed in R1-1613692 with following updates

- Consider followings for minimum system information transmission:
  - NR-PBCH is a non-scheduled broadcast channel carrying at least a part of minimum system information with fixed payload size and periodicity predefined in the specification depending on carrier frequency range

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611371	QCL assumption of NR Synchronization Signals and DM RS of Broadcast Channel	CATT
R1-1611372	Multiplexing of Broadcast Channel and Synchronization Channels	CATT
R1-1611443	Issues Related to NR-PBCH	ZTE, ZTE Microelectronics
R1-1611695	Design of broadcast signal/channel	Huawei, HiSilicon
R1-1611716	Discussion on PSS/SSS/PBCH in numerology multiplexing	NEC
R1-1611786	Discussion on SS Block and SS Burst	LG Electronics

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R1-1611787	NR PBCH Design	LG Electronics
R1-1611788	Consideration on DL Channel for System Information Delivery	LG Electronics
R1-1611789	NR Paging Design	LG Electronics
R1-1611901	System information delivery in NR	Ericsson
R1-1611902	System information for low complexity and extended coverage	Ericsson
R1-1611903	NR SFN of broadcast channel	Ericsson
R1-1611967	Number of Antenna Ports for PBCH	Intel Corporation
R1-1612027	Single beam PBCH design	Qualcomm Incorporated
R1-1612122	Broadcast channel design for system information acquisition	MediaTek Inc.
R1-1612456	Discussion on essential SI delivery for over6GHz	Samsung
R1-1612457	Essential System Information (SI) and on-demand SI	Samsung
R1-1612458	NR paging channel design	Samsung
R1-1612628	Considerations for DL Broadcast Channel for Initial Access in NR	InterDigital Communications
R1-1612722	Discussion on broadcast signal/channel design for NR	NTT DOCOMO, INC.
R1-1613008	Discussion of PBCH Transmission in NR	Convida Wireless LLC
R1-1613271	Way forward on multi-beam paging	Huawei, HiSilicon
R1-1613452	WF on Essential System Information Delivery	LG Electronics, NTT DOCOMO, Qualcomm

7.1.2.3 Physical random access channel

R1-1611904 NR PRACH preamble design Ericsson

- *Observation 1: For digital beamforming, a large number of FFTs are required in both transmitters and receivers*
- *Observation 2 For analog beamforming, a beam sweeping might be needed during one or several PRACH preambles*
- *Observation 3 The PRACH preamble can be designed such that the time interval to include in each beamforming can be selected in gNB without configuring the UE*
- *Proposal 1 The PRACH preamble should enable the use of the same receiver FFT as for other reference signals, user data and control channels.*
- *Proposal 2 The PRACH preamble is based upon repetition of one OFDM symbol of the same length as other frequency multiplexed user data or control OFDM symbols*

Decision: The document is noted.

R1-1612031 Multi-beam RACH design and evaluation Qualcomm Incorporated

- *Observation 1: The UE could sweep its receiver beams and subarrays while receiving synchronization signals to find the best subarray and UL transmit beam combination before transmitting random access signals.*
- *Observation 2: For CDL-C models at 30 GHz, our design meets 0.1% false alarm and 1% probability of missed detection at approximately -19 dB pre-beamforming per tone SNR where SNR also included antenna element gain.*
- *Observation 3: For CDL-C model, the timing error of our design is distributed between -12 to +12 sample shifts.*
- *Proposal 1: The design should allow base stations to sweep beams during synchronization and random access period.*
- *Proposal 2: Base station should use beam reciprocity to the extent possible between transmitting DL synchronization signals and receiving UL random access signals.*
- *Proposal 3: If beam reciprocity at BS holds, UE can select a subset of symbols of the random access subframe based on the signal strengths of DL synchronization beams to transmit RACH signal.*
- *Proposal 4: Every X msec, Y msec worth of resources are allocated for the transmission of a random access burst. Each random access burst consists of N nominal random access symbols. The exact values of X, Y and N are FFS (example: X=20, Y=0.625, N=14). The values of X, Y and N should be known to the UE.*

Decision: The document is noted.

R1-1612462 Preamble design aspects for NR RACH without beam correspondence Samsung

- *Proposal 1: for multi-beam operations without beam correspondence, NR preamble design should additionally consider facilitating beam alignment at gNB, i.e. estimation of preferred beam, on top of LTE preamble design principles.*
- *Proposal 2: for multi-beam operations without beam correspondence, Tx beam for msg 3 should be measured from preamble and indicated to UE. Differential beamforming based preamble structure can be considered as a candidate.*

Decision: The document is noted.

R1-1612708 Views on random access channel for NR NTT DOCOMO, INC.

Proposal 1: The RACH preamble format(s) in LTE should be considered as the basic RACH preamble.
Proposal 2: For each subcarrier spacing of the RACH preamble, length of the slot containing only uplink channel/signal is considered as the reference to the preamble length.
Proposal 3

- *Scalable numerologies are applied to the basic RACH preamble*
  - *Preamble formats 0, 1, 2 and 3 with a subcarrier spacing of 1.25kHz are the reference formats.*
    - *FFS: support for preamble format 4*

- *Based on reference formats, the subcarrier spacings of 2.5kHz, 5kHz, 10kHz and 20kHz are supported.*
  - *FFS: other subcarrier spacings, e.g., 0.725kHz, 40kHz*

Observation:

- *The MCL for RACH preamble is degraded when larger subcarrier spacing/BW. However, larger subcarrier spacing is robust against higher Doppler frequency.*
- *Scalable RACH preamble would be applicable to higher carrier frequency and multi-beam operation.*
- *Shorter sequence length for RACH preamble compared to LTE can be considered for larger subcarrier spacing depending on the required timing estimation accuracy.*

Decision: The document is noted.

Tuesday session

R1-1613169 **WF on Preamble format design** **NTT DOCOMO, ETRI, ZTE**

The document was presented by Kazuaki Takeda from NTT DOCOMO.

- For the consecutive multiple/repeated RACH preambles,
  - Option 1: CP is inserted at the beginning of the consecutive multiple/repeated RACH sequences, CP/GT between RACH sequences is omitted and GT is reserved at the end of the consecutive multiple/repeated RACH sequences
  - Option 2: The same RACH sequences with CP is repeated and GT is reserved at the end of the consecutive multiple/repeated RACH sequences
  - Option 3: The same RACH sequences with CP/GT is repeated
  - For options 2 and 3, the same RACH sequences with and without CP/GT can be further multiplied with different orthogonal cover codes and transmitted.
  - For example, the consecutive multiple/repeated RACH preambles would be used when Tx/Rx beam correspondence does not hold at either TRP or UE
- For a single RACH preamble, CP/GT are required for each RACH preamble
  - For example, the single RACH preamble would be used when Tx/Rx beam correspondence held at both TRP or UE for multi-beam operation
- The BW for a RACH preamble transmission is targeted to not be wider than 5 MHz for a carrier frequency of below 6 GHz and not wider than X MHz for a carrier frequency ranging from 6GHz to 52.6 GHz
  - X could be, e.g., 5, 10, and 20MHz
- At least, one reference numerology for RACH preamble is defined, e.g.,
  - 1.25 x 2^n kHz
  - 15 x 2^n kHz
    - Integer value of n is FFS
  - Other values are not precluded
- Based on the reference numerology for RACH preamble, multiple RACH preambles with scalable numerologies are supported depending on the carrier frequency
- The following sequences can be considered for the evaluation
  - ZC sequence
  - m-sequence
- Companies are encouraged to provided their proposed sequence length

Decision: The document is noted, modified and agreed as follows:

Agreements:

- Following options can be further considered for the consecutive multiple/repeated RACH preambles,
  - Option 1: CP is inserted at the beginning of the consecutive multiple/repeated RACH sequences, CP/GT between RACH sequences is omitted and GT is reserved at the end of the consecutive multiple/repeated RACH sequences
  - Option 2: The same RACH sequences with CP is used and GT is reserved at the end of the consecutive multiple/repeated RACH sequences
  - Option 3: The same RACH sequences with CP/GT is used
  - Option 4: Different RACH sequences with CP is used and GT is reserved at the end of the consecutive multiple/repeated RACH sequences
  - Option 5: Different RACH sequences with CP/GT is used
  - For options 2 and 3, study further that the same RACH sequences with and without GT can be further multiplied with different orthogonal cover codes and transmitted.
  - For example, the consecutive multiple/repeated RACH preambles would be used when Tx/Rx beam correspondence does not hold at TRP
  - Other options are not precluded
- For a single RACH preamble transmission, CP/GT are required
  - For example, the single RACH preamble would be used when Tx/Rx beam correspondence held at both TRP or UE for multi-beam operation

Agreements:

- The maximum bandwidth for a RACH preamble transmission is not wider than 5 MHz for a carrier frequency of below 6 GHz and not wider than X MHz for a carrier frequency ranging from 6 GHz to 52.6 GHz
  - X will be down selected from 5, 10, and 20MHz
- At least, one reference numerology for RACH preamble is defined,
  - 1.25 x n kHz
  - 15 x n kHz
    - Integer value of n is FFS
  - Other values are not precluded
- Based on the reference numerology for RACH preamble, multiple RACH preambles with scalable numerologies are supported depending on the carrier frequency

Agreements:

- The following sequences can be considered for the evaluation
  - ZC sequence
  - m-sequence
  - Other sequences are not precluded
- Companies are encouraged to provided their proposed sequence length

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611271	Random access preamble structure and signaling	ZTE, ZTE Microelectronics
R1-1611373	NR RACH Preamble Design Consideration	CATT
R1-1611461	Discussion on PRACH configuration in NR	Fujitsu
R1-1611694	Considerations on NR RACH preamble and channel design	Huawei, HiSilicon
R1-1611790	Discussion on NR PRACH Preamble for Single-beam and Multi-beam Operation	LG Electronics
R1-1611791	Consideration on Numerology for NR RACH Preamble	LG Electronics
R1-1611905	NR PRACH resource allocation	Ericsson
R1-1611906	NR PRACH preamble evaluations	Ericsson
R1-1612030	Single beam RACH design	Qualcomm Incorporated
R1-1612032	Single beam RACH evaluation	Qualcomm Incorporated
R1-1612037	Reciprocity vs. Non-reciprocity in Initial Access/RACH	Qualcomm Incorporated
R1-1612142	Considerations on 2-step RACH physical channel design	MediaTek Inc.
R1-1612296	Cyclic delay-Doppler shifted M-Sequences for New Radio PRACH	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612297	Design Considerations for RACH Preamble Formats	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612459	Discussion on RACH preamble length	Samsung
R1-1612460	RACH resource for MSG1 transmission	Samsung
R1-1612461	RACH preamble format considering beam correspondence	Samsung
R1-1612746	Discussion on RACH numerology and procedure	Motorola Mobility

7.1.2.4 Initial access procedure

R1-1611684 Summary of email discussion [86b-20] on synchronization and carrier rasters for NR Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei.

Proposal 1: The raster for NR synchronization signals can be different per frequency range. At least for frequency ranges where NR supports a wider carrier bandwidth and operation in a wider frequency spectrum (e.g. above 6 GHz), the NR synchronization signals raster can be larger than the 100 kHz raster of LTE.

Proposal 2:

- The candidate frequency locations of synchronization signals for NR should not be restricted to be located at the center of NR carrier.
- The candidate frequency locations of synchronization signals for NR should support the 100 kHz raster in existing bands.

Proposal 3: RAN1 should first decide the supported minimum and maximum carrier bandwidths for NR, and the supported bandwidths of synchronization signals for NR, before further details of the frequency rasters for synchronization signals and center of NR carrier are determined.

Observation: The scenarios where synchronization signal(s) of neighbour cells may not be on the same center frequency require further study, taking into consideration network deployment (HetNet or macrocells), potential benefits of inter-cell interference coordination on the synchronization signals, and UE complexity.

Decision: The document is noted. Continue offline

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Agreements:

- The raster for NR synchronization signals can be different per frequency range. At least for frequency ranges where NR supports a wider carrier bandwidth and operation in a wider frequency spectrum (e.g. above 6 GHz), the NR synchronization signals raster can be larger than the 100 kHz raster of LTE.
- A joint decision should be made on:
  - the supported minimum carrier bandwidth for a NR carrier
  - the supported bandwidths of synchronization signals for NR
  - the frequency raster for synchronization signals for NR
  - the frequency raster for the center of NR carrier (if applicable)

Possible agreement: Synchronization signal(s) of neighbour cells are on the same center frequency for intra-frequency measurements
Further revised as:

Possible agreement:

- From UE perspective,
  - synchronization signal(s) of neighbour cells can be measured on the same frequency location for intra-frequency measurements
  - synchronization signal(s) that are on different frequency locations belongs to inter-frequency measurements can be measured

Possible agreement: NR design should strive to allow that the candidate frequency locations of synchronization signals for NR should not be restricted to be located at the center of NR carrier, considering the overall UE detection complexity of synchronization signals for cell search and RRM measurements
Continue offline discussion

R1-1613563 **WF on Synchronization Raster Qualcomm**

Working assumptions:

1. For a NR cell, the center frequency for the synchronization signal can be different from the center frequency of the NR carrier
   1. FFS: Relationship between the center frequency of the NR carrier and the center frequency of synchronization signals and investigate tradeoff between UE complexity and flexibility

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The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611272	Overview of NR initial access	ZTE, ZTE Microelectronics
R1-1611374	NR Initial Access Procedure with multi-stage synchronization signals	CATT
R1-1611651	On numerology determination during initial access	Huawei, HiSilicon
R1-1611667	Unified single/multiple beam operations for initial access	Huawei, HiSilicon
R1-1611668	Unified on-demand initial access signals transmission for connected and idle UE Mobility	Huawei, HiSilicon
R1-1611688	NR initial access evaluation	Huawei, HiSilicon
R1-1611792	Discussion on Initial Access Procedure	LG Electronics
R1-1611793	Discussion on Multi-TRP Operation Considering Analog Beamforming	LG Electronics
R1-1611794	Discussion on Essential System Information Transmission	LG Electronics
R1-1611908	NR initial access procedure	Ericsson
R1-1611969	On NR initial access and mobility	Intel Corporation
R1-1612033	2 step and 4 step RACH	Qualcomm Incorporated
R1-1612034	Conveying symbol index during multi-beam SYNC	Qualcomm Incorporated
R1-1612130	Initial Access with Visible Multi-beam Operation	MediaTek Inc.
R1-1612181	Gradual UE specific (GUS) initial access and channel associations	CMCC
R1-1612229	NR synchronization signal and DL broadcast signal	Panasonic Corporation
R1-1612255	Further discussion on beam management in random access procedures	Beijing Xinwei Telecom Techn.
R1-1612274	Initial access in non-standalone scenarios	FUJITSU Laboratories of Europe
R1-1612289	Efficient design of SS block	ASTRI, TCL Communication Ltd.
R1-1612309	A framework for initial access for NR	INTERDIGITAL COMMUNICATIONS
R1-1612361	NR Initial Access Procedure Design	AT&T GNS Belgium SPRL
R1-1612463	Discussion on beam sweeping for initial access signals	Samsung

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R1-1612464 Initial access procedure for sub6GHz Samsung
R1-1612465 Initial access procedure for over6GHz Samsung
R1-1612609 Physical Layer Considerations for Random Access Procedure in Massive MIMO NR National Instruments Corp.
R1-1612631 Performance Evaluation for Hierarchical Initial Access Design InterDigital Communications
R1-1612650 Discussion on the numerology during initial access procedure Potevio
R1-1612723 Discussion on initial access procedure for NR NTT DOCOMO, INC.
R1-1612801 On Synchronization Signals for Single-beam and Multi-beam Configurations Nokia, Alcatel-Lucent Shanghai Bell
R1-1612808 Cell Identification in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612809 Beam management in initial access Nokia, Alcatel-Lucent Shanghai Bell
R1-1612902 Impact of multiplexing multiple numerologies on initial access ASUSTEK COMPUTER (SHANGHAI)

7.1.2.5 Random access procedure

R1-1611273 Unified RACH procedure ZTE, ZTE Microelectronics

Proposal 1: A RACH group is a combination of
- *A subset of RACH resources and*
- *A subset of PRACH preambles.*

Proposal 2: RACH groups are disjoint if (and only if) any combination of RACH resource and preamble is contained in at most one RACH group.
Proposal 3: The following RACH procedure is considered
- *Association(s) between one or multiple occasions of DL channel(s)/signal(s) and disjoint RACH group(s) is informed to UE by broadcast system information or dedicated configuration or is known to the UE.*
- *Based on the DL measurement and the corresponding association, UE selects the RACH group.*

Proposal 4: RACH procedure for connected mode UEs supports the selection of RACH group based on measurements on UE-specific signals defined for connected mode mobility.
Proposal 5: A partial indication of the best measurement result by RACH group selection can be considered, e.g. for cases where the number of measurement results is greater than the number of disjoint RACH groups that can be selected. Using MSG3 to complete the indication can be considered.
Proposal 6: Which beam a UE selects for RACH preamble transmission is up to the UE.
Proposal 7: A UE should be allowed to perform UE Tx beam sweeping of preambles, in the selected RACH group.
Proposal 8: Fixed or configurable limitations to the amount or rate of preamble transmissions for UE Tx beam sweeping should be considered.
Proposal 9: If a UE is informed that it should perform multiple repeated preamble transmission, then it should use the same UE Tx beam for those preamble transmissions.

Decision: The document is noted.

R1-1611687 NR RACH evaluation Huawei, HiSilicon

- *Observation 1: In LLS for below 6GHz, multi-TRP independent reception shows better detection error probability compared with single TRP reception. The SNR of multi-TRP independent achieves -16dB and -11dB in AWGN and CDL-C channel respectively, compared with the single TRP case of -9dB and -5dB.*
- *Observation 2: In LLS for below 6GHz, multi-TRP joint reception shows better detection error probability compared with multi-TRP independent reception in low SNR. The SNR of multi-TRP achieves -20dB and -11dB in AWGN and CDL-C channel respectively, compared with the single TRP case of -16dB and -11dB.*
- *Observation 3: In SLS for below 6GHz, lower miss detection rate can be achieved by multi-TRP joint detection compared to single-TRP detection. Based on multi-TRP joint detection, miss detection rate of contention-free UE-dedicated preamble transmission can be kept close to zero for up to 200 simultaneously preamble transmissions in SLS evaluation.*
- *Observation 4: In LLS for above 6GHz, multi-TRP joint reception improves the performance significantly.*
- *Observation 5: In SLS for above 6GHz, multi-TRP joint reception improves the performance.*
- *Proposal 1: NR should support the multi-TRP reception to enhance the PRACH detection performance, for below 6GHz.*
- *Proposal 2: NR should support the multi-TRP reception to enhance the PRACH detection performance, for above 6GHz.*

Decision: The document is noted.

R1-1613120 RACH Procedure Considering Multi-TRP Operation LG Electronics (revision of R1-1611795)

- *Observation 1: Multiple RACH resources can be configured due to multiple beam/TRP operation.*
- *Proposal 1: In terms of association with DL broadcast channel/signal and RACH resource, it should be studied whether the DL broadcast channel/signal is cell-specifically transmitted signal with SFN manner from multiple TRPs or TRP specific channel/signal.*
- *Proposal 2: Study whether/how to support multiple RACH procedure per UE.*
- *Proposal 3: For the retrial of RACH preamble, it should be UE choice whether the UE transmits PRACH preamble on the same RACH resource (retransmission) or UE transmits PRACH preamble on the different RACH resource targeting different TRP/beam (retrial).*

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Decision: The document is noted.

Tuesday session

R1-1613138 WF on NR RACH procedure for multi-beam operation without beam correspondance Samsung

The document was presented by … from Samsung.

- Regardless of beam correspondence is available or not at UE, in RACH procedure at least for multiple beam operation, the followings are supported at least for UE in idle mode:
  - UE reports TRP Tx beam for Msg. 2 transmission in Msg. 1
    - FFS: through preamble sequence ID, and/or RACH resource selection
  - UL Tx beam for Msg. 3 transmission is determined
    - Opt 1, gNB indicates UE Tx beam for Msg. 3 in Msg. 2
      - Further consider how to facilitate determination of UE Tx beam from Msg. 1:
        - Searching via beam sweeping;
        - Probing via Differential beamforming;
        - Others are not precluded.
    - Opt 2, UE selects UL Tx beam used for Msg. 3 transmission, e.g.,
      - Reuse the UL Tx beam used for Msg. 1 transmission
      - Selects a Tx beam different from that used for Msg. 1 transmission
      - Others are not precluded.
    - Others are not precluded.

Decision: The document is noted.

R1-1613281 WF on RACH procedure ZTE, ZTE Microelectronics, NTT DOCOMO

The document was presented by Patrick Svedman from ZTE.

- The following RACH procedure is considered:
  - UE beam correspondence (Tx/Rx reciprocity) is transparent to TRP
  - UE Tx beam(s) for preamble transmission(s) is selected by the UE.
  - Multiple/repeated preambles are transmitted with the same UE Tx beam.
    - Note: Multiple/repeated preambles corresponds to multiple/repeated preambles informed by broadcast system information.
  - UE may switch UE Tx beam between re-transmissions of multiple/repeated preambles
  - Study further the options:
    - Option 1: UE may transmit preamble with different UE Tx beam before receiving Message 2
    - Option 2: UE may not transmit preamble with different UE Tx beam before receiving Message 2
  - Message 2 indicates time, frequency and sequence of detected preamble to indicate detected UE Tx beam.
    - FFS whether UE is mandated to use the indicated UE Tx beam for Message 3.
  - At TRP, the DL Tx beam for the UE can be obtained based on the time, frequency and sequence of the detected RACH preamble and would be also applied to Message 2

Decision: The document is noted.

Possible agreements:

- NR supports the following procedure(s) for msg1 re-transmission
  - Power ramping for NR < 6GHz
  - Power ramping, UE beam switching, and RACH resource switching for NR > 6GHz
    - FFS: Down-selection or combination of the above mechanisms
    - FFS: How to combine power ramping, UE beam switching, and RACH resource switching depending on number of TRP Rx beams, UE Tx beams, number of RACH resources

Agreements:

- NR supports the following procedure(s) for msg1 re-transmission
  - Down selection or combination of power ramping, UE beam switching, and RACH resource switching
    - FFS: How to combine power ramping, UE beam switching, and RACH resource switching depending on number of TRP Rx beams, UE Tx beams, number of RACH resources
    - FFS: Whether to consider different procedures depending on the single-TRP/beam or multi-TRPs/beams
  - Other options for all frequency ranges are not precluded.

Continue offline discussion until Wednesday – (ZTE, Samsung)

Wednesday session

R1-1613543 WF on UE beam switching ZTE, ZTE Microelectronics

Agreements:

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- UE Tx beam(s) for preamble transmission(s) is selected by the UE.
  - During a RACH transmission occasion of single or multiple/repeated preamble(s) as informed by broadcast system information, UE uses the same UE Tx beam.

R1-1613539 **WF on Remaining Issues on RACH Procedures** **NTT DOCOMO, CATT, Mitsubishi Electric**

Agreements:

- Regardless of whether Tx/Rx reciprocity is available or not at gNB at least for multiple beams operation,
  - At gNB, the DL Tx beam for message 2 can be obtained based on the detected RACH preamble/resource and the corresponding association
    - UL grant in message 2 may indicate the transmission timing of message 3
- NR will support different PRACH configurations, e.g., considering different numerologies case and whether Tx/Rx reciprocity is available or not at gNB

Possible agreements from Samsung:

Regardless of beam correspondence is available or not at UE, in RACH procedure at least for multiple beam operation, the followings are supported at least for UE in idle mode:

- UL Tx beam for Msg. 3 transmission is determined
  - Opt 1: UE Tx beam for Msg. 3 is determined by gNB in Msg. 2
    - Further consider how to facilitate determination of UE Tx beam from Msg. 1:
      - Searching via beam sweeping;
      - Probing via differential beamforming;
      - Others are not precluded.
  - Opt 2: UE Tx beam for Msg. 3 is determined by UE, e.g.,
    - Selects the same UL Tx beam used for Msg. 1 transmission
    - Selects a different UL Tx beam from that used for Msg. 1 transmission
    - Others are not precluded.
    - Note: the determination can be done by adjustment based on the feedback from gNB in Msg. 2.
  - Others are not precluded.

Note: the further down selection/conclusion (if needed) should consider the outcome of beam correspondence discussion.

Agreements:

1. In RACH procedure, the followings are considered at least for UE in idle mode:
   1. UL Tx beam for Msg. 3 transmission is determined by UE,
      1. UE may use the same UL Tx beam used for Msg. 1 transmission.
      2. FFS: if determination can be assisted by additional signaling from gNB if necessary and how to determine UL Tx beam for Msg. 3
   2. Others are not precluded

R1-1613545 **WF on load balancing across PRACH resources** **Intel**

Agreements:

- RAN1 studies further on
  - the support of different RACH resource subset size that is associated with one or multiple occasions for DL broadcast channel/signal
    - FFS: whether other parameters of each RACH resource subset can be different
    - FFS: How the different RACH resource subset size information is conveyed to UE
  - the support of same RACH resource subset size that is associated with one or multiple occasions for DL broadcast channel/signal and non-uniform transmission of DL broadcast channel/signal across different directions in a multi-beam scenario
  - Other mechanisms to load balance RACH resource subset is not precluded

R1-1613546 **WF on UE beam determination CATT**
R1-1613547 **Way Forward on Two-Step RACH Fallback** **Nokia, Interdigital**

R1-1613717 WF on CONNECTED mode random access ZTE, ZTE Microelectronics

Agreements:

1. NR supports random access procedure for CONNECTED mode UEs

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R1-1613685 Way Forward on Two-Step RACH Procedure Nokia, ASB, Mediatek, Ericson
R1-1613716 WF on Message 2 reception window ZTE, ZTE Microelectronics

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611274 On 2-step RACH procedure in NR ZTE, ZTE Microelectronics
R1-1611375 NR RACH Procedure CATT
R1-1611376 Discussion of Simplified RACH Procedures CATT
R1-1611462 Discussion on RAR in NR considering reciprocity issues Fujitsu
R1-1611669 RACH procedures for unified single/multiple beam based access Huawei, HiSilicon
R1-1611728 RACH preamble transmission and reception Mitsubishi Electric Co.
R1-1611796 Discussion on RACH Procedure with Tx/RX Reciprocity LG Electronics
R1-1611797 Discussion on RACH Procedure without Tx/RX Reciprocity LG Electronics
R1-1611798 On Simplified RACH Procedure LG Electronics
R1-1611910 NR random access procedure Ericsson
R1-1611911 NR random-access response design Ericsson
R1-1611912 On NR random-access response signal format Ericsson
R1-1611913 Numerology for NR Random Access and data Ericsson
R1-1611970 Random Access Procedure for NR Intel Corporation
R1-1612035 RACH timeline consideration Qualcomm Incorporated
R1-1612036 Beam refinement for random access procedure Qualcomm Incorporated
R1-1612144 Discussion on Flexible RACH Procudure MediaTek Inc.
R1-1612182 RACH in Gradual UE-specific (GUS) initial access CMCC
R1-1612218 On 2-step RACH procedure for high speed train scenario for NR ETRI
R1-1612298 Impact of UE TX/RX beam correspondence and non-correspondence Nokia, Alcatel-Lucent Shanghai Bell
R1-1612299 Random access principles for new radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1612300 PRACH Resource Configuration for Single-Beam and Multi-Beam Nokia, Alcatel-Lucent Shanghai Bell
R1-1612310 Random access and support for multiple numerologies for NR INTERDIGITAL COMMUNICATIONS
R1-1612311 Random access procedure INTERDIGITAL COMMUNICATIONS
R1-1612362 NR Random Access Procedure Design AT&T GNS Belgium SPRL
R1-1612466 RA procedure with and without beam correspondence Samsung
R1-1612467 Power ramping versus beam switching Samsung
R1-1612468 Discussion on simplified RACH procedure Samsung
R1-1612469 RACH procedure considering flexible UE bandwidth Samsung
R1-1612622 Multi-beam operation on RACH procedure in NR Sharp
R1-1612709 Views on random access procedure for NR NTT DOCOMO, INC.
R1-1612765 Considerations on Resource Request in NR III
R1-1612890 Considerations on Multiple Beams RACH Procedure Sony

7.1.2.6 Mobility procedure

R1-1611916 Inclusion of cell ID in MRS Ericsson

- Observation 1: Supporting both IDLE cell signals and ACTIVE mobility RS with an optional possibility to identify the originating cell for ACTIVE mode mobility allows a range of network solutions to match particular deployment conditions and operator preferences.
- Observation 2: In case the UE knows that a set of away MRSs belong to the same node it may e.g. use this knowledge when deciding if the time-to-trigger (TTT) have to be reset or not.
- Observation 3: In case the UE knows that a set of away MRSs belong to the same node it may e.g. use this knowledge to generate a composite estimate that may better reflect the quality the UE can expect after a handover.
- Observation 4: The cost of providing the UE with information related to grouping of MRSs may be significant.
- Observation 5: To enable non-serving cell MRS grouping, cell identifier (CID) info may need to be associated with the MRS transmissions.
- Observation 6: It is preferable to associate the local CID info in the MRS due to lower resource usage impact.
- Observation 7: In wider-band MRS configurations, the inclusion of CID may not imply a significant resource usage increase.
- Observation 8: CID information transmission in MRS consumes system resources.
- Proposal 1: The inclusion CID info in MRS, or other grouping support features, should be configurable by the NW.

Decision: The document is noted.

R1-1611971 Mobility for NR Intel Corporation

- Proposal 1: Mobility in RAN1 should be defined as handover from one NR cell to another NR cell, and TRP/Beam switching/selection procedure should be defined as beam management.

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- Proposal 2: RAN1 assumes RRM measurements can be performed as part of Beam management during RRC_CONNECTED mode
- Proposal 3: Mobility during IDLE mode is provided by RRM measurements based on NR SS
- Proposal 4: Benefits of UL based mobility, compared to DL based mobility, should be studied with performance analysis, including consideration of UE power consumption, signal overhead, and uplink resource utilization.
- Proposal 5: RAN1 should study whether uplink control signals and measurement reporting can perform the functionalities of uplink based mobility during RRC_CONNECTED mode.
- Proposal 6: Implications to RAN1 and RAN2 should be studies further for supporting uplink based mobility for IDLE mode.

Decision: The document is noted.

R1-1612183 **On separating mobility and data transmission CMCC**

- Proposal 1: Broadcast beam is configured, where synchronization signals, broadcast signals, randon access related signals, as well as other initial access related signals are configured using the same analog beam pattern, specifically, these beams are formed using the same predefined set of beamforming weights. The broadcast beam function at transmission/reception of NR-PSS/SSS/broadcast signals/random access related signals/on-demand SIB/paging signals etc.

- Proposal 2: Mobility management is based on broadcast beams, that is RRM measurement is also on broadcast beams.
- Proposal 3: L1/L2 mobility measurement for the broadcast beams can be based on cell related RS which is carrying Cell-ID (e.g. NR-PSS, NR-SSS) or RS for mobility or RS for demodulating broadcast channel or RS for beam management or a combination of them. The broadcast beam set used for L1/L2 mobility measurement can be a subset of the broadcast beams used for L3 mobility.
- Proposal 4: From spec perspective, the following two alternatives or a combination of them for associating RRM measurement in L3 and L1/L2 mobility needs to be considered
  - Alt 1: Same or partially same RS ports for RRM measurement are configured for L3 and L1/L2 mobility.
  - Alt 2: Different RS ports for RRM measurement are configured for L3 and L1/L2 mobility, but linkage such as QCL is specified between these ports.
- Proposal 5: Self-contained data-related is configured, where data related control channel, shared channel as well as CSI measurement RSs are configured using the same analog beam pattern. The data-related beams function at transmission/reception of PDCCH/ PDSCH/ PUCCH/ PUSCH/ SRS/ CSI-RS/ DMRS.
- Proposal 6: Data-related beam is decoupled from broadcast beam and TRP/cell concept. In such a way, dynamic switching or joint transmission between multiple beams/TRPs may be done in a spec transparent manner.Proposal 7: From specification perspective, there is no linkage between the beamforming weights for broadcast beam and data-related self-contained beam. In other words, the channels in broadcast beam and the channels in data-related self-contained beam cannot share reference signals.

Decision: The document is noted.

Tuesday session

R1-1613140 **WF on NR RRM Measurements AT&T, Ericsson**

- NR should support adaptation and UE-specific configuration of the timing for RRM measurements and reports.
- NR should support dynamic or semi-static (e.g. RRC configured) adaptation/configuration of the RRM measurement bandwidth.
- RAN1 should study mechanisms to support adaptation and configuration of the time/frequency resources used for RRM measurements for both 'CONNECTED' and non-'CONNECTED' mode UEs.
- It is up to RAN4 for determining requirements regarding the extent the UE can restrict its measurement to a subband of the configured bandwidth

Decision: The document is noted. Continue offline discussion until Wednesday – Thomas (AT&T)

Wednesday session

R1-1613554 **WF on NR RRM Measurements AT&T, NTT DOCOMO, Orange**

Agreements:

- NR should support adaptation and network indication of the valid time and frequency resources which may be used for inter-/intra-frequency RRM measurements and reports for 'CONNECTED' mode UEs
  - FFS: UE-specific and/or cell-specific indication
  - FFS: dynamic adaptation/configuration
  - FFS: idle and possibly new state modesz
  - FFS: whether to support aperiodic
- It is up to RAN4 for determining requirements regarding the extent the UE can restrict its measurement to a subband of the configured bandwidth

R1-1613568 **WF on DL signal for CONNECTED mode RRM measurement LG Electronics, Samsung, ~~CMCC~~**

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Not co-sourced by CMCC, but by Mediatek
R1-1613569 **WF on RRM measurement quantity in CONNECTED mode** **LG Electronics, Samsung, ~~CMCC~~**
Not co-sourced by CMCC, but by Mediatek

Agreements:

- For cell level measurement in multiple beam operation scenario, following examples for RRM measurement quantity in connected mode can be considered for evaluations
  - Example 1: The quantity is measured on the best received DL signal resource for RRM measurement
  - Example 2: The quantity is a function of quantities measured on best received "N" DL signal resources for RRM measurement
  - FFS : value of N,
  - FFS: N is fixed in the specification; or can be signaled via RRC signaling on the RRM measurement configuration
  - Other options are not precluded.

R1-1613678 **WF on Mobility RS** **Samsung, MediaTek, NTT DOCOMO, CATT, Qualcomm, Huawei, LGE, Ericsson, Intel**

Agreements:

- Consider the following signal combinations for inter-cell RRM measurements for CONNECTED and IDLE until RAN1-NR:
  - Option 1: Same RS
    - Option 1-1: NR-SSS and/or NR-PSS
    - Option 1-2: MRS-1 (Multi-port multi-beam reference signal multiplexed in a SS block)
    - Option 1-3: MRS-2 (Multi-port multi-beam reference signal not multiplexed in a SS block)
    - Option 1-4: MRS-3 (Single/Multi-port single-beam reference signal)
    - Option 1-5: NR-SSS and DM-RS for PBCH if DM-RS is supported for PBCH
  - Option 2: Not same RS
    - Option 2-1: NR-SSS in IDLE; MRS-{1,2} in CONNECTED
    - Option 2-2: NR-SSS in IDLE; NR-SSS and MRS-{1,2} in CONNECTED
    - Option 2-3: NR-PSS and/or NR-SSS in IDLE; NR-PSS and/or NR-SSS and CSI-RS in CONNECTED
    - Option 2-4: For CONNECTED, RS for IDLE and MRS-{1,2,3}
- Companies are encouraged to bring results and analysis until RAN1-NR considering at least the following aspects:
  - Cell coverage in CONNECTED and IDLE
  - Overhead of RS resources (e.g. Number of resource elements, BW used for RS mapping, Resource usage in time)
  - Accuracy of the RS measurement quantity
- The following impacts resulting from selecting IDLE mode RS option can also be considered for multi-beam case:
  - Performance in DL/UL signal reception after RACH before RRC connection, in relation to the associated beams obtained during RACH procedure

R1-1613603 **WF on RRM measurement in IDLE mode MediaTek, Intel, Samsung, NTT DoCoMo**

Agreements:

- ~~1.~~• For RAN1 evaluations for IDLE mode, the default bandwidth for DL RRM measurement assumed by UE is not larger than the minimum carrier bandwidth which may depend on the frequency band
  - ~~1.~~o FFS: mMTC case

R1-1613449 WF on RRM measurement in CONNECTED mode LG Electronics

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611249 Views on UL based mobility Huawei, HiSilicon
R1-1611250 UL based measurement mechanisms and procedures for UE Huawei, HiSilicon
R1-1611275 Idle mode mobility ZTE, ZTE Microelectronics
R1-1611276 Connected mode mobility ZTE, ZTE Microelectronics
R1-1611377 NR RRM measurements and mobility management CATT
R1-1611542 Cell quality measurements for NR mobility Sony
R1-1611686 UL reference signal design for measurement Huawei, HiSilicon

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R1-1611799 Discussion on RRM Measurement in IDLE Mode LG Electronics
R1-1611800 Discussion on RRM Measurement in CONNECTED Mode LG Electronics
R1-1611801 Considerations on UL Based Measurement LG Electronics
R1-1611907 Filtering of connected mode RS Ericsson
R1-1611909 MRS resource allocation Ericsson
R1-1611914 NR Synchronization signals for idle and connected mode mobility Ericsson
R1-1611915 On NR DL mobility measurement signal design Ericsson
R1-1612038 UL based mobility PUMICH scalability analysis Qualcomm Incorporated
R1-1612039 Updated highway rural mobility evaluations Qualcomm Incorporated
R1-1612040 DL based mobility DL channels Qualcomm Incorporated
R1-1612041 UL based mobility DL channels Qualcomm Incorporated
R1-1612042 UL based mobility UL channels Qualcomm Incorporated
R1-1612043 NR DL/UL mobility for active and inactive states Qualcomm Incorporated
R1-1612044 DL/UL mobility in above 6 GHz bands Qualcomm Incorporated
R1-1612123 DL RRM Measurement over Narrowband Reference Signals MediaTek Inc.
R1-1612141 RRM enhancement in aid of UL signal MediaTek Inc.
R1-1612364 RRM Measurements for NR AT&T GNS Belgium SPRL
R1-1612470 Mobility RS design for supporting multi-beam operations Samsung
R1-1612471 NR mobility in connected mode Samsung
R1-1612472 Discussion on mobility RS BW for over6GHz Samsung
R1-1612473 UL Mobility Analysis Samsung
R1-1612474 NR mobility in idle mode Samsung
R1-1612475 Cell Quality Derivation from Beam Quality Samsung
R1-1612476 Mobility Support for RRC Inactive UEs Samsung
R1-1612477 Discussion on initial beam association Samsung
R1-1612724 Discussion on mobility procedure for NR NTT DOCOMO, INC.
R1-1612810 Considerations on DL and UL mobility in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612811 DL Signals for Mobility Measurements and mobility schemes in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612892 UL Mobility Scenarios for NR Sony
R1-1613010 Discussion on NR Mobility Convida Wireless LLC
R1-1613011 L1 Design Issues for UL Mobility Sony

7.1.2.7 Others

R1-1611277 Considerations on paging transmission ZTE, ZTE Microelectronics

7.1.3 MIMO

R1-1612317 On NR MIMO below 6 GHz Ericsson

7.1.3.1 Multi-antenna scheme

MIMO design including Open-loop/Close-loop MIMO, Transmission diversity, SU/MU-MIMO, Multi TRP transmission/reception

R1-1611406 Discussion on DL MIMO transmission for NR ZTE, ZTE Microelectronics
R1-1611673 Closed-loop coordinated transmission scheme Huawei, HiSilicon
R1-1611972 Discussion on NR transmit diversity scheme Intel Corporation
R1-1612307 Non-linear Precoding for NR IITH
R1-1612319 Number of layers for UL MIMO Ericsson
R1-1612365 Multi-Point Transmission Schemes for NR AT&T GNS Belgium SPRL
R1-1612482 DMRS-based precoder cycling and simulation results Samsung
R1-1612838 Further studies on benefits and possible specification impacts of nonlinear precoding schemes Mitsubishi Electric Co.
R1-1612847 On the support for frequency selective precoding in UL MIMO Nokia, Alcatel-Lucent Shanghai Bell

R1-1613159 WF on DL MIMO transmission schemes for data transmission Huawei, HiSilicon, Nokia, ASB, NTT DOCOMO, Ericsson, MediaTek
Decision: The document is noted. Also supported by China Unicom

R1-1613172 WF on DMRS based DL semi-open-loop Samsung, Intel, LGE, ZTE, ZTE Microelectronics
Decision: The document is noted.
Possible agreements:
- For NR, support DL DMRS based semi-open-loop transmission with following:
  - ~~o~~ FFS on transmission schemes
    - E.g. precoder cycling. Tx diversity and layer permutation

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- FFS on the detailed CSI contents and reporting
  - E.g partial PMI or resource indicator with CQI feedback
- FFS on the selection of transparent and/or non-transparent DMRS
  - Transparent DMRS: DMRS and data precoded identically
  - Non-transparent DMRS: DMRS and data precoded differently

R1-1613650 WF on DL MIMO transmission schemes for data transmission Huawei, HiSilicon, NTT DOCOMO, Ericsson, MTK, China Unicom, Intel, Samsung, Qualcomm, LGE, Xinwei

Agreements:

1. Support at least the following DMRS based DL MIMO transmissions for data in NR,
   1. Scheme 1: Closed-loop transmission where data and DMRS are transmitted with the same precoding matrix
      1. Demodulation of data at the UE does not require knowledge of the precoding matrix used at the transmitter
      2. Note: spatial multiplexing and rank-1 are included
   2. Scheme 2: Open loop and Semi-open loop transmissions where data and DMRS may or may not be restricted to be transmitted with the same precoding matrix
      1. Demodulation of data at the UE may or may not require knowledge of the relation between DMRS ports and data layers
      2. Note: DMRS can be precoded or not precoded
      3. Study the transmission schemes, e.g., SFBC, Large delay CDD, Layer shifting, small delay CDD
      4. Study the selection of transparent and/or non-transparent DMRS
         1. Transparent DMRS: DMRS and data precoded identically
         2. Non-transparent DMRS: DMRS and data precoded differently

R1-1613109 WF on number of CW(s) for NR Intel, Ericsson, Qualcomm, Panasonic

Agreements:

1. The number of codeword(s) per one scheduled physical data channel in NR both for DL and UL
   1. For 1-2 MIMO layers – FFS between 1 codeword and 2 codewords
   2. For 3-8 MIMO layers FFS among
      1. Alt 1: 1 codeword
      2. Alt 2: 2 codewords
      3. Alt 3: >= 3 codewords
   3. Study the above alternatives taking into account performance of NC-JT transmission from two or more beams/TRPs, overhead in DCI/UCI (ACK/NACK, CQI)
   4. Study support of overhead reduction schemes such indication for the maximum number of MIMO layers from TRP, ACK/NACK spatial bundling, etc.
   - Study possible use of different modulations in single codeword
   5. Study the possibility of configurable number of codewords per UE by NW

Wednesday session

R1-1613174 WF on UL MIMO Waveform for NR Samsung, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, AT&T, CATT

1. When a UE is configured with UL SU-MIMO transmission with rank adaptation from rank-1 to rank-L_{MAX}, CP-OFDM waveform is used for L-layer transmission where L=1, 2, …, L_{MAX}
   - L_{MAX} is the maximum number of layers

Decision: The document is noted.

Possible working assumption:

- UL transmission with rank adaptation always uses CP-OFDM waveform
- FFS: Support fall back mode using DFT-S-OFDM waveform indicated by dynamic signalling in rank = 1

Thursday session

R1-1613672 WF on the frequency selective precoding for UL MIMO Samsung, Xinwei, NTT DOCOMO, ZTE, ZTE Microelectronics, Huawei, HiSilicon

Agreements:

2. For the purpose of discussions, replace the classifications 'closed-loop'/'open-loop' with method-based classification of 'precoding' and 'precoder cycling'
   1. Signalling and UL-CSI measurement support are to be addressed separately
   2. Both precoding and precoder cycling can be considered for UL DMRS-based spatial multiplexing (SM)

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- 3. Note: For only CP-OFDM waveform, SFBC is covered by this clarification
- 3. Frequency selective precoding is supported for UL MIMO with CP-OFDM waveform when the transmission ports is greater than X
  - 1. Following examples can be studied
    - 1. Example 1: Precoding information for a given partial BW is explicitly indicated by gNB
      - 1. The precoding information can be indicated through a hierarchical indication manner with wideband W1 and subband W2
        - 1. W1 and W2 can be signaled in one DCI or two separate DCIs
    - 2. Example 2: A single beam group in UL codebook is indicated by BS for UL transmission in perspective of the system bandwidth
      - 1. Example 2a: Precoder cycling is adopted within the beam group
      - 2. Example 2b: The UE has certain flexibility to decide which particular beam/precoder in the beam group for actual transmission.
    - 3. Example 3: Reciprocity based precoding
    - 4. Other examples are not precluded
  - 2. FFS: X value

R1-1613754 **WF on UL-MIMO Terminology Nokia, ASB, Interdigital, Mitsubishi, Huawei, HiSilicon**

Conclusion:

- 1. RAN1 can still continue discussion in the next meeting regarding how to refine the terminology related "closed-loop/precoding" and "open-loop/precoder cycling (including transmit diversity)"

R1-1613583 **WF on NR Transmission Mode Intel Corporation, AT&T, Samsung, LG, Huawei**

Agreements:

- 1. Define at least two sets of transmission parameters, where
  - 1. Transmission parameter set 1: parameters configured (FFS: L1 or L2 or L3)
    - 1. For default transmission scheme, specify default values of parameters in the Transmission parameter set 1
      - 1. FFS: Whether default value can be derived implicitly
    - 2. Note that depending on parameter settings in transmission parameter set 1, the size of transmission parameter set 2, i.e. DCI size, may vary.
  - 2. Transmission parameter set 2: parameters indicated by physical layer (e.g. NR PDCCH channel)
    - 1. FFS whether multiple subsets is supported and how to simplify DCI format
  - 3. Note: some transmission parameter may belong to both set-1 and set-2
  - 4. Detail parameters and usage condition are TBD

R1-1613440 **WF on multi-panel based MIMO for DL and UL transmissions Huawei, HiSilicon, Xinwei**

Agreements:

- 1. For multi-panel based downlink transmission
  - 1. Should consider both uniform and non-uniform array
  - 2. Should consider both coherent and non-coherent MIMO transmission for multi-panel antenna array
  - 3. Should consider different inter-panel phase calibration cases
  - 4. FFS QCL related aspects
- 2. For multi-panel based uplink transmission
  - 1. Study way(s) to improve both reliability and capacity, e.g., non-coherent transmission, etc.
  - 2. Study practical issues including multiple timing advances, power control, beam procedure with/without the help of existing well paired beams and so on
  - 3. Should consider different inter-panel phase calibration cases

R1-1613413 **Way Forward – WF on PRG size Qualcomm, Intel, Ericsson, Interdigital**

Agreements:

- 1. For DL data, support at least a PRB bundling size for precoding equal to a specified value
  - 1. FFS whether specified value is system BW dependent
  - 2. FFS: Supported values
- 2. Study further including at least the following:
  - 1. FFS PRB bundling size linked to resource allocation granularity (e.g. RBG, etc.)
  - 2. FFS whether or not a PRB bundling size equals to all the contiguous scheduled PRBs
  - 3. FFS the case of reciprocity based operation

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4. FFS whether or not a PRB bundling size equals to a configured value(s) irrespective of scheduled PRBs

R1-1613156 WF on CSI-RS configuration for coordinated transmission LG Electronics, Intel Corporation, NTT DOCOMO

Agreements:

1. NZP CSI-RS resource is defined in NR, as a set of NZP CSI-RS port(s) mapped to a set of REs within a frequency span/a time duration (details FFS) which can be measured at least to derive a CSI
    1. Multiple NZP CSI-RS resources can be configured to UE at least for supporting CoMP and multiple beamformed CSI-RS based operations, where
        1. Each NZP CSI-RS resource at least for CoMP can have different number of CSI-RS ports.
2. Further study at least the following aspects:
    1. FFS QCL aspects
        1. E.g., set of QCL parameters
        2. E.g., QCL assumptions within a NZP CSI-RS resource, among two or more resources, etc.
    2. FFS whether or not a single NZP CSI-RS resource can be used to derive two or more CSIs
    3. FFS whether or not many NZP CSI-RS resources can be used to derive a single CSI

R1-1613676 Way Forward – WF on UL PRG size Qualcomm, InterDigital

Agreements:

1. Study further the PRB bundling size for precoding for UL data
    1. DFT-S-OFDM based transmissions
        1. Consider the case of contiguous scheduled PRBs and non-contiguous scheduled PRBs (if supported)
        2. Consider the impact due to UL DM-RS design
    2. CP-OFDM based transmissions
        1. Considering aspects related to non-reciprocity based CP-OFDM transmission (if supported) and reciprocity based CP-OFDM transmission (if supported)

R1-1613533 WF on Evaluation Assumptions for Advanced Receivers based on Network Coordination Samsung, Ericsson, Nokia, Intel, MediaTek, Orange, CeWiT, IITH, IITM, Tejas Networks (Revision of R1-1613297)

Agreements:

2. For advanced receivers based on network coordination, system-level simulation are encouraged to be evaluated in NR study item
3. For system-level simulations, urban macro scenario, dense urban scenario excluding small cells, indoor hotspot scenario, and dense urban scenario including small cells with the same carrier frequency are encouraged to be evaluated in NR study item
4. Simulation assumptions of TR 38.802 can be a starting point
    1. FFS whether or not to further update the simulation assumptions
5. Details on additional information assumed in evaluations should be provided by each company

R1-1613681 WF on Evaluation Assumptions for Advanced Receivers based on Network Coordination Samsung, Ericsson, Nokia, Huawei Intel, MediaTek, ZTE, Orange, CeWiT, IITH, IITM, Tejas Networks

R1-1613230 WF on NR Network Coordination Samsung, Xinwei, NTT DOCOMO, Huawei, HiSilicon

Agreements:

1. NR supports both semi-static and dynamic network coordination schemes
    1. Study interference measurement details
        1. Including aspects related to measurement sets
    2. The network coordination schemes should consider at least the following schemes:
        1. DPS/DPB
        2. CS/CB
        3. Non-coherent JT
        4. Coherent JT
        5. eICIC
        6. Whether each scheme requires specification support or not is FFS

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Petitioners' Exhibit 1007, p. 1275
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

R1-1613144 WF on NR Multi-Point Transmission AT&T, Huawei, HiSilicon, Ericsson

Agreements:

- In supporting semi-static and dynamic network coordination schemes in NR, different coordination levels should be considered.
  - E.g., centralized and distributed scheduling, the delay assumption used for coordination schemes, etc.

R1-1613435 WF on transparent coordinated transmission set Huawei, HiSilicon, Ericsson, Samsung
R1-1613434 WF on CSI measurement reporting for coordinated transmission Huawei, HiSilicon, AT&T

Agreements:

- Aim for a common framework for CSI measurement and reporting for different types of coordinated transmission schemes
- Study whether or not to have the assumption/indication of interference hypothesis

R1-1613439 WF on advanced receiver for coordinated transmission Huawei, HiSilicon, Cohere, AT&T, DT, Orange

Agreements:

- NR should consider advanced receiver at the UE, by studying:
  - Joint reception of multiple data streams from one or more TRPs/panels
  - Interference cancellation/suppression
    - One or more data stream(s)
    - Reference signal(s)
  - Potential notification the UE of the information related to interfering signals, e.g., MCS, CSI-RS ports, DM-RS pattern and transport block size, # of layers, MIMO mode, etc.
  - Potential blind detection of information regarding interference
  - Potential joint channel estimation and reception of data
  - Potentially different numerologies (e.g., tone spacing, etc.)

R1-1613436 WF on coordinated transmission Huawei, HiSilicon, AT&T
R1-1613429 WF on channel reciprocity calibration in NR MIMO Fujitsu, National instruments, Cohere Technologies, Interdigital, Indian Institute of Technology

Agreements:

- Study network side calibration to assist cross-TRP and cross-panel operation, e.g.:
  - Necessity of same-panel calibration and specification impact, if any
  - Potential UE-aided calibration: transmit/receive calibration signaling between gNB and UE(s)
    - E.g., UE-aided calibration may use feedback from UE to gNB
  - Other methods to assist cross-TRP and cross-panel operation are not precluded

R1-1613749 WF on UL MIMO Transmission Huawei, HiSilicon

R1-1611234	DMRS-based transmission schemes for DL MIMO	Huawei, HiSilicon
R1-1611235	Discussion on UL MIMO transmission	Huawei, HiSilicon
R1-1611378	Discussion on transmission schemes for NR MIMO	CATT
R1-1611379	Further discussion on UL MIMO for NR MIMO	CATT
R1-1611407	Discussion on UL MIMO transmission for NR	ZTE, ZTE Microelectronics
R1-1611409	Discussion on interference issues in NR	ZTE, ZTE Microelectronics
R1-1611410	Multi-TRP transmission for NR	ZTE, ZTE Microelectronics
R1-1611533	Channel reciprocity calibration for NR MIMO	FUJITSU Laboratories of Europe
R1-1611664	Multi-panel based DL MIMO transmission	Huawei, HiSilicon
R1-1611665	Multi-panel based UL MIMO transmission	Huawei, HiSilicon
R1-1611672	Open-loop coordinated transmission scheme	Huawei, HiSilicon
R1-1611706	Discussion on Multi-antenna Scheme	Guangdong OPPO Mobile Telecom.
R1-1611802	Discussion on UL-MIMO schemes for NR	LG Electronics
R1-1611803	Discussion on multi-TRP transmission for NR	LG Electronics
R1-1611804	Discussion on diversity achieving MIMO techniques for NR	LG Electronics
R1-1611805	UE antenna array structure for above 6GHz NR	LG Electronics

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Petitioners' Exhibit 1007, p. 1276
AT&T et al v. Asustek Technology & Celerity
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R1-1611973	On codeword to MIMO layer mapping	Intel Corporation
R1-1612045	Discussion on phase continuity and PRB bundling	Qualcomm Incorporated
R1-1612046	DL open-loop MIMO transmission schemes	Qualcomm Incorporated
R1-1612047	Uplink MIMO transmission schemes	Qualcomm Incorporated
R1-1612145	On the open loop scheme for the UE specific transmission mode	MediaTek Inc.
R1-1612164	Discussion on NR Transmission Mode	Intel Corporation
R1-1612165	On sub-band based precoding for UL	Intel Corporation
R1-1612184	Updated simulation results with DL MU-MIMO in analog domain	CMCC
R1-1612256	Further discussion on NR multi-antenna schemes	Beijing Xinwei Telecom Techn.
R1-1612318	On codewords and layer mapping	Ericsson
R1-1612320	UL MIMO for NR	Ericsson
R1-1612321	Robust Transmission Schemes for PDSCH	Ericsson
R1-1612322	Multiple-TRP transmissions for NR	Ericsson
R1-1612478	DMRS-based spatial multiplexing for DL NR MIMO	Samsung
R1-1612479	DMRS-based spatial multiplexing for UL NR MIMO	Samsung
R1-1612480	Further discussions on transmission schemes, transmission modes and control signaling	Samsung
R1-1612481	Discussion on precoding granularity in NR	Samsung
R1-1612484	Discussions on NR network coordination	Samsung
R1-1612485	Overview of coordinated interference cancellation	Samsung
R1-1612486	Transmission and reception of coordinated interference cancellation	Samsung
R1-1612487	Network coordination for coordinated interference cancellation	Samsung
R1-1612488	Physical layer abstraction method for coordinated interference cancellation	Samsung
R1-1612489	Evaluation assumption for advanced receivers based on network coordination	Samsung
R1-1612633	Impact of UE Calibration in a Reciprocity-based UL MIMO Transmission	InterDigital Communications
R1-1612634	Reciprocity-based UL Beamformed Transmit Diversity	InterDigital Communications
R1-1612635	Non-linear Precoding for NR	InterDigital Communications
R1-1612636	MIMO transmission scheme for NR	InterDigital Communications
R1-1612725	Discussion on MIMO Transmission with TDD channel reciprocity	NTT DOCOMO, INC.
R1-1612726	Discussions on High order MU-MIMO Transmission for NR	NTT DOCOMO, INC.
R1-1612738	CW to layer mapping	Qualcomm Incorporated
R1-1612836	Views on abstraction of nonlinear precoding schemes for SLS	Mitsubishi Electric Co.
R1-1612837	Performance evaluation of nonlinear precoding schemes for NR MU-MIMO	Mitsubishi Electric Co.
R1-1612840	Decoupled Control and Data for NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612841	Non-coherent Multi-node Transmission for URLLC in the 5G New Radio	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612842	High-level principles for beam coordination and Link Adaptation in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612843	Impact of Antenna Panel Array Structures in UMa 30GHz	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612844	On the support of transmit diversity in NR for data and control channels	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612845	Unified MIMO transmission mode for NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612846	UL MIMO transmission in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612849	DL SU-MIMO Performance Characteristics in UMa 30GHz	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612850	DL MU-MIMO Performance Characteristics in UMa 30GHz	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612851	Network Coordination to support advanced receivers	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612852	Interference Aware Inter Cell Rank Coordination	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612965	Discussion on multi TRP transmission/ reception	China Unicom
R1-1613001	Non-Linear Precoding for Downlink Multiuser MIMO	Huawei, HiSilicon
R1-1613012	Discussion on DL MIMO Transmission in NR	Convida Wireless LLC
R1-1613062	Discussion on NR network coordination and beam management	Samsung
R1-1613103	Discussions on High order MU-MIMO Transmission for NR	NTT DOCOMO
R1-1613106	Multi-TRP transmission for NR	ZTE, ZTE Microelectronics
R1-1613109	WF on number of CWs for NR	Intel
R1-1613121	Evaluation of a Flexible MIMO Feedback Design for NR	AT&T GNS Belgium SPRL
R1-1613144	WF on Multipoint Transmission for NR	AT&T
R1-1613159	WF on DL MIMO transmision shemes for data transmission	Huawei
R1-1613172	WF on DMRS based DL semi-open-loop	Samsung
R1-1613173	WF on SRS for NR	Samsung
R1-1613230	WF on NR Network Coordination	Samsung
R1-1613231	WF on the frequency selective precoding for UL MIMO	Samsung
R1-1613290	WF on NR Transmission Mode	Intel
R1-1613297	WF on evaluation assumptions for advanced receivers based on network coordination	Samsung
R1-1613413	WF on PRG size	Qualcomm Inc.
R1-1613429	WF on channel reciprocity calibration in NR MIMO	Fujitsu
R1-1613435	WF on transparent coordinated transmission set	Huawei

R1-1613436 WF on coordinated transmission Huawei
R1-1613437 WF on open-loop coordinated transmission Huawei
R1-1613438 WF on advanced receiver support for coordinated transmissionHuawei
R1-1613439 WF on DL transmission modes and schemes Huawei
R1-1613440 WF on multi-panel based MIMO for DL and UL transmissions Huawei

7.1.3.2 Reference signal and QCL

R1-1611236 Independent and joint control of CSI-RS transmission and CSI reporting for NR MIMO Huawei, HiSilicon
R1-1611380 Further discussion on SRS transmission for NR CATT
R1-1611381 Consideration on CSI-RS transmission for NR CATT
R1-1611413 On QCL and QCB for NR MIMO ZTE, ZTE Microelectronics
R1-1611806 Discussion on QCL assumptions for NR LG Electronics
R1-1611807 Considerations on NR CSI-RS design LG Electronics
R1-1612051 Views on DL DMRS Qualcomm Incorporated
R1-1612146 On the downlink demodulation reference signal design for the normal CP MediaTek Inc.
R1-1612052 Views on RS for control and tracking Qualcomm Incorporated
R1-1612329 DMRS positioning Ericsson
R1-1612610 Harmonized Reference Signal Structure for Phase Noise & Reciprocity National Instruments Corp.
R1-1612639 Impact of phase noise reference signals on the link performance InterDigital Communications

R1-1613186 WF on CSI-RS Transmission Schemes NTT DOCOMO, CATT, Cohere Technologies, Ericsson, LG Electronics, Nokia, ASB, Samsung
Continue discussion offline

Tuesday session
Agreements:
- NR supports semi-persistent CSI-RS transmissions
  - Activation(s)/de-activation(s) of CSI-RS resource is triggered dynamically
    - Note: "dynamically" here can be DCI and/or MAC CE based. FFS details.
- NR supports semi-statically configured/re-configured periodic CSI-RS transmissions
- FFS: Details on signaling mechanisms

R1-1613367 WF on QCL for NR ZTE, ZTE Microelectronics, ASTRI, Nokia, ASB, Samsung, AT&T
Possible agreements:
- Support UE feedback to assist QCL association between reference signal resources/ports with respect to UE spatial QCL parameter(s) to support UE side beamforming/receiving procedure.

R1-1613719 WF on QCL for NR ZTE, ZTE Microelectronics, ASTRI, Nokia, ASB, Samsung
Also supported by AT&T

Agreements:
1. Study the need of supporting UE feedback and contents if needed to assist QCL association between reference signal resources/ports with respect to UE spatial QCL parameter(s) to support UE side beamforming/receiving procedure
2. Companies are encouraged to provide details of beamforming/receiving procedures and evaluate performance in terms of at least following metrics:
   1. RS overhead
   1. Overhead of UE feedback
   2. Spectral efficiency

R1-1613368 WF on Reference Signal for Demodulation ZTE, ZTE Microelectronics, ASTRI, Samsung, Ericsson, Qualcomm

Agreement:
- Support variable/configurable DMRS pattern for data demodulation
  - FFS: Time and/or frequency domain density can be configured
  - FFS: RE location can be configured

Possible agreements:
- For low latency application, support multi-set DL DMRS for data demodulation
  - One set at least contains ~~is~~ front-loaded at least for demodulation
    - FFS: other motivations

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- Other set(s) can be configured for different motivations
  - e.g. higher frequency/time density, Rx beam detection, phase noise compensation
- Note: DMRS pattern design is based on the basic scheduling unit
- FFS: URLLC DMRS design
- FFS: multi-set UL DMRS for data demodulation

Agreement:

- Support variable/configurable DMRS pattern for data demodulation
  - At least one configuration supports front-loaded DMRS pattern

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Wednesday session

R1-1613369 WF on NR SRS Huawei, HiSilicon, Xinwei

Agreements:

- In NR, SRS can be configurable w.r.t. density in frequency domain (e.g., comb levels) and/or in time domain (including multi-symbol SRS transmissions)
  - Details FFS
- FFS details on how the set of port(s) and resources for SRS can be indicated by gNB

R1-1613470 WF on SRS transmission for NR CATT, CATR, Xinwei, Spreadtrum Communications (Revision of R1-1613424)

Agreements:

- For SRS transmission for NR,
  - The size of partial-band is configurable and smallest size can be N PRB(s).
    - FFS the value of N
  - FFS simultaneous multiple partial-bands transmission is supported depending on UE capability
- NR to support SRS transmission where the numerology(ies) can be configurable for a UE.
  - FFS details (e.g., a single vs. multi-numerology by configuration, a single numerology SRS transmission at a time vs. simultaneous multi-numerology SRS transmission, etc.)

R1-1613570 WF on CSI-RS for beam management Samsung, NTT DOCOMO, Ericsson, MediaTek (Revision of R1-1613350)

- CSI-RS supports the TRP Tx beam sweeping and UE Rx beam sweeping
- The following parameters for CSI-RS transmission can be configured to the UE
  - Alt 1:
    - N_T = 1, 2, ..., $N_{T,Max}$: Number of time blocks for TRP Tx beam sweeping
    - N_R = 1, 2, …, $N_{R,Max}$: Number of time units within each time block for supporting UE Rx beam sweeping
  - Alt 2:
    - N_R = 1, 2, …, $N_{R,Max}$: Number of time blocks for UE Rx beam sweeping
    - N_T = 1, 2, ..., $N_{T,Max}$: Number of time units within each time block for TRP Tx beam sweeping
  - N_P = 1, 2, …, $N_{P,max}$: Total number of CSI-RS ports per time unit
    - Different CSI-RS ports can correspond to differently steered beams
  - For periodic and semi-persistent CSI-RS transmission, periodicity and offset (in terms of slots or subframes).
  - Other parameters are not precluded
  - FFS:
    - Whether explicit or implicit configuration of N_T, N_R, and N_P is supported
    - Whether above parameters are configured with one or multiple CSI-RS resource configurations
    - CSI-RS resource configuration(s) mechanism, e.g. RRC vs dynamic (L1/L2)
  - NOTE: CSI-RS can be used in P1, P2, P3

Decision: The document is noted.

R1-1613669 WF on CSI-RS for beam management Samsung, NTT DOCOMO, Ericsson, MediaTek, Intel, CATT, AT&T, InterDigital

Agreements:

1. CSI-RS supports the DL Tx beam sweeping and UE Rx beam sweeping
2. NOTE: CSI-RS can be used in P1, P2, P3
3. NR CSI-RS supports the following mapping structure
   1. N_P CSI-RS port(s) can be mapped per (sub)time unit
      1. Across (sub)time units, same CSI-RS antenna ports can be mapped

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- 2. Values of N_P is FFS
- 3. Here, "time unit" refers to $n>=1$ OFDM symbols in a configured/reference numerology, where the value of n is FFS
  - 1. FFS whether OFDM symbols comprising a time unit is consecutive or not
- 4. FFS Port multiplexing method, e.g., FDM, TDM, CDM, any combinations

2. Each time unit can be partitioned into sub-time units
   - 1. FFS Partitioning method, e.g., TDM, IFDMA, OFDM symbol-level partition with same/shorter OFDM symbol length(i.e. larger subcarrier spacing) as/than the reference OFDM symbol length (subcarrier spacing), and other methods are not precluded
3. This mapping structure can be used for supporting multiple panels/Tx chains
4. Options to map CSI-RS for Tx and Rx beam sweeping for further study
   - 1. Option 1:
     - 1. Tx beam(s) are same across sub-time units within each time unit
     - 2. Tx beam(s) are different across time units
   - 2. Option 2:
     - 1. Tx beam(s) are different across sub-time units within each time unit
     - 2. Tx beam(s) are same across time units
   - 3. Option 3: combination of Alt1 and Alt2:
     - 1. Within one time unit, Tx beam(s) are same across sub-time units.
     - 2. Within another time unit, Tx beam(s) are different across sub-time units.
     - 3. FFS combination of the different time units in terms of e.g., number and periodicity
   - 4. Note that only Tx sweeping or Rx sweeping is also a possibility
   - 5. Other options are not precluded.
   - 6. FFS: how to capture "same beam" and "different beam" in spec
- 4. FFS: Whether the above mapping structure is configured with one or multiple CSI-RS resource configurations

R1-1613553 WF on RS for phase tracking Huawei, HiSilicon, Intel, National Instruments, ETRI, Samsung, LG Electronics, Ericsson, NTT DOCOMO, CMCC, InterDigital, Nokia, Alcatel-Lucent Shanghai Bell, Mitsubishi Electric, CATT, MediaTek

- Phase tracking RS is denoted as PT-RS
- PT-RS supports the following for CP-OFDM:
  - Time-domain density of mapped on every other symbol and/or every symbol
    - FFS: Whether/how to down-select the time-domain density
    - Note: Other time-domain densities of PT-RS are not precluded
  - At least for UL
    - The presence of PT-RS is UE-specifically configured
      - FFS: Whether implicit and/or explicit UE-specific configuration is supported
    - PT-RS is confined in the scheduled time/frequency duration for a UE
  - FFS: UE-specific and/or non-UE-specific and/or cell-specific for DL

Discussion: Also supported by Convida Wireless
Concern from ZTE with the naming "PT-RS" – why use the purpose of RS for phase tracking only?
Chair→ let's make it as a Working Assumption – objected by ZTE
Clarification requested by ZTE: FFS whether new RS is introduced or extended DMRS is used for phase tracking.
Decision: The document is noted.

Agreements:

- RS for Phase tracking is denoted as PT-RS
  - FFS: Naming of RS
- PT-RS supports the following for CP-OFDM:
  - Time-domain density of mapped on every other symbol and/or every symbol and/or every 4-th symbol
    - FFS: Whether/how to down-select the time-domain density
    - Note: Other time-domain densities of PT-RS are not precluded
  - At least for UL
    - The presence of PT-RS is UE-specifically configured
      - FFS: Whether implicit and/or explicit UE-specific configuration is supported
    - PT-RS is confined in the scheduled time/frequency duration for a UE
  - FFS: UE-specific and/or non-UE-specific and/or cell-specific for DL
- The following are to be studied for PT-RS:
  - Number of PT-RS ports to be supported
  - Use of precoding
  - QCL relationship with other RS, e.g., DM-RS

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- Details on frequency domain pattern(s) and/or variable frequency domain densities
- Whether PT-RS is necessary for DFT-s-OFDM waveform
- Sharing of time/frequency resource between PT-RS among UEs and/or among layers of a single UE
- Additional usage for estimating residual frequency offset and/or high-speed channel
- Possible method(s) to improve phase estimation performance from PT-RS
  - E.g., using ZP/NZP PT-RS to reduce interference
- Details of UE-specific configuration, e.g., associated with the scheduled MCS and/or BW, the number of scheduled layers, or use dedicated signaling
- Others are not precluded

FFS whether new RS is introduced or extended DMRS is used for phase tracking

Thursday session

R1-1613108 WF on spatial QCL parameter for NR Intel (4)

Working assumption:

1. Spatial parameter(s) for QCL in NR describes the spatial channel properties of the RS antenna ports observed at the receiver.
2. FFS: Spatial parameter(s) in NR also describes the spatial channel properties of the antenna ports at transmitter(s).
3. Support UE reporting for related information, if necessary.

R1-1613152 WF on QCL assumptions in NR LG Electronics, Intel Corporation, KT Corporation
R1-1613660 WF on number of orthogonal DMRS ports Mitsubishi Mitsubishi Electric, Huawei, Samsung, Ericsson, CATT, Softbank, KDDI
Also supported by Fujitsu
Conclusion: Study necessity of supporting 16 orthogonal DMRS ports in DL and UL considering symmetric design both for DL and UL

R1-1613601 WF on RS for common control resource set Qualcomm, ZTE
R1-1613111 WF on RS for beam management Intel
R1-1613430 WF on DMRS design for different channels Samsung, ZTE, ZTE Microelectronics, Qualcomm Incorporated
R1-1613164 Way Forward on DL DMRS Qualcomm, Ericsson, ZTE, ZTE Microelectronics
Also supported by Samsung
R1-1613588 WF on DMRS pattern evaluation LG Electronics, NTT DOCOMO, Samsung
R1-1613651 WF on DMRS Pattern Evaluation LG Electronics, NTT DOCOMO, Samsung, Intel, MediaTek

Agreements:

1. Organize two email discussions i) to collect companies proposals on DMRS design for DL data channel for NR to facilitate evaluation for the next RAN1 meetings till 8th Dec. and ii) to discussion/agree on simulation assumptions till 15th Dec. – Hyunsoo (LGE)
   1. The companies are encouraged to provide DM-RS patterns including DM-RS design details such as
      1. Time domain density (per antenna port) for different ranks (e.g., number of DMRS symbols in slot, symbol position, etc.)
      2. Frequency domain density (per antenna port) for different ranks
      3. The number of maximum orthogonal ports
      4. Multiplexing of DMRS ports (e.g., TDM, FDM, CDM, etc.)
      5. DM-RS sequence (e.g., PN, Zadoff-Chu, etc.)
2. For the RAN1 NR Ad-hoc meeting, companies are encouraged to provide performance evaluation and to clarify the following aspects used for evaluation:
   1. Channel estimation method (e.g. IFFT type, MMSE type and LS type including assumptions on pipe-line or interpolation/extrapolation for data demodulation, etc.)
   2. PRB bundling assumption
   3. Considering of noise limited and interference limited scenarios
   4. Companies to state phase noise assumptions

R1-1613621 WF on unified CSI-RS framework Huawei, HiSilicon, ZTE, ZTE Microelectronics
R1-1613746 WF on Type I & Type II CSI Feedback Huawei, HiSilicon, China Unicom, Intel, Samsung, Ericsson, CATT, LGE
Also supported by Nokia, Alcatel-Lucent Shanghai Bell

Agreements:

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- For Type I CSI, PMI codebook has at least two stages W = W1W2
  - W1 codebook comprises of beam groups/vectors
  - FFS structure and configuration of W1 codebook, e.g. number of ports, grid of beams, orthogonal, non-orthogonal, beam broadening, etc
  - FFS frequency granularity of W1 and W2 reporting
  - FFS on additional support of W3 (location of W3 matrix is FFS), e.g. multi-panel support, analog beam selection
  - Note multi-panel support may be captured in W1, W2 and/or W3
- For Type II CSI,
  - Study the following CSI feedback schemes
    - Analog CSI feedback
    - Linear combination based CSI feedback
      - For example
        - Projection of channel and/or covariance matrix and/or eigenvectors onto a basis
        - Linear combination of a basis
        - Schemes may have orthogonal and/or non-orthogonal basis
      - Quantization examples
        - Magnitude and phase
        - Real and imaginary
        - Vector quantization
    - Precoder / Precoding Matrix
    - Downloadable codebook
    - Contents for Quantized or Unquantized CSI feedback
      - Channel covariance matrix feedback
        - e.g. Hermitian-form codebook, analog CSI feedback, linear combination codebook
      - Channel Approximation and/or Measurement
        - e.g. analog CSI feedback, linear combination codebook
      - Channel Eigen vectors
        - e.g. analog CSI feedback, linear combination codebook
      - Other forms of channel representation are not excluded.

R1-1613173 WF on SRS for NR Samsung, Ericsson, LG Electronics, CATT, AT&T, Xinwei, NTT DOCOMO, ZTE, ZTE Microelectronics

Agreements:

- An NR-SRS resource comprises of a set of resource elements (RE) within a time duration/frequency span and N antenna ports (N ≥ 1)
  - FFS on the time duration/frequency span
- A UE can be configured with K ≥ 1 NR-SRS resources
  - Consider the maximum value of K to be a UE capability to avoid mandatory support for large values of K

R1-1611239	Details of QCL assumptions and related RS design considerations	Huawei, HiSilicon
R1-1611240	Reference signal design for phase tracking	Huawei, HiSilicon
R1-1611241	DL CSI-RS design for NR CSI acquisition	Huawei, HiSilicon
R1-1611242	DL RS design for NR Beam Management	Huawei, HiSilicon
R1-1611243	DL shared/group RS and UE-specific RS for control channel demodulation	Huawei, HiSilicon
R1-1611244	DL DM-RS for data transmissions	Huawei, HiSilicon
R1-1611245	DL RS design for downlink-based RRM measurement and TRP/beam discovery	Huawei, HiSilicon
R1-1611246	Functionalities and design of reference signal for demodulation of UL Channels	Huawei, HiSilicon
R1-1611382	Discussion on phase tracking RS for NR	CATT
R1-1611383	DMRS design for NR MIMO	CATT
R1-1611411	Discussion on flexible DMRS patterns	ZTE, ZTE Microelectronics
R1-1611412	Discussion on measurement related reference signals	ZTE, ZTE Microelectronics
R1-1611414	On number of CSI-RS ports for NR MIMO	ZTE, ZTE Microelectronics
R1-1611463	Aggregated CSI-RS configuration and signaling	Fujitsu
R1-1611476	Considerations on UL sounding RS design for NR MIMO	Spreadtrum Communications
R1-1611678	UL SRS Design for CSI Acquisition and Beam Management	Huawei, HiSilicon
R1-1611707	On time-domain SRS structure for channel reciprocity-based DL MIMO	Guangdong OPPO Mobile Telecom.

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R1-1611808	Considerations on NR SRS design	LG Electronics
R1-1611809	Reference Signal for Frequency offset and Phase Tracking	LG Electronics
R1-1611810	Discussion on Phase Tracking RS for UL transmission	LG Electronics
R1-1611811	Discussion on Phase Tracking RS for Multi-Antenna	LG Electronics
R1-1611812	DMRS Design Principle	LG Electronics
R1-1611813	NR DMRS Pattern	LG Electronics
R1-1611814	Discussion on Variable Density for NR DMRS	LG Electronics
R1-1611815	Considerations on Reference Signal for Control Channel	LG Electronics
R1-1611816	Discussion on RS for RRM Measurement and RLF	LG Electronics
R1-1611974	Study of DM-RS pattern for NR	Intel Corporation
R1-1611975	Study on PRB bundling for NR	Intel Corporation
R1-1611977	On CSI-RS for NR	Intel Corporation
R1-1611978	Multi-carrer QCL for NR	Intel Corporation
R1-1611979	On spatial parameters for QCL	Intel Corporation
R1-1611980	Views on the remaining details of QCL	Intel Corporation
R1-1611981	On phase tracking for NR	Intel Corporation
R1-1612048	Views on CSI-RS	Qualcomm Incorporated
R1-1612049	Views on SRS	Qualcomm Incorporated
R1-1612050	Views on UL DMRS design	Qualcomm Incorporated
R1-1612053	Views on Quasi Co-Located Antenna Ports	Qualcomm Incorporated
R1-1612054	Phase and frequency tracking reference signal considerations	Qualcomm Incorporated
R1-1612185	Consideration on flexible SRS configuration and transmission for NR	CMCC
R1-1612186	Phase noise reference signal design for high frequency systems	CMCC
R1-1612187	Phase noise modeling and reduction	CMCC
R1-1612219	Discussion on NR downlink reference signal design	ETRI
R1-1612257	Disucssion on RS design and QCL related issues	Beijing Xinwei Telecom Techn.
R1-1612323	Introducing port coherency regions	Ericsson
R1-1612324	On QCL	Ericsson
R1-1612325	DMRS design principles	Ericsson
R1-1612326	On UL DM-RS	Ericsson
R1-1612327	Concatenated block RS design	Ericsson
R1-1612328	DMRS placement in transmission slots aggregation	Ericsson
R1-1612330	CSI-RS design	Ericsson
R1-1612331	On the number of CSI-RS ports	Ericsson
R1-1612332	SRS design	Ericsson
R1-1612333	Design considerations for phase noise tracking RS	Ericsson
R1-1612334	On DL and UL CPE compensation in MIMO	Ericsson
R1-1612335	On phase noise effects	Ericsson
R1-1612336	On PRB bundling	Ericsson
R1-1612337	On the number of scrambling codes for DM-RS	Ericsson
R1-1612338	On phase tracking in DFT-S-OFDM waveform	Ericsson
R1-1612339	IC-friendliness vs configurable DM-RS	Ericsson
R1-1612340	On DM-RS stucture	Ericsson
R1-1612341	DMRS density configurations in the time domain	Ericsson
R1-1612342	DMRS placement configurations	Ericsson
R1-1612343	On densification of DM-RS patterns	Ericsson
R1-1612344	On block RS design enabling low CM	Ericsson
R1-1612367	CSI-RS Design for Mixed Numerology Support in NR	AT&T GNS Belgium SPRL
R1-1612375	On common RS design between DFT-S-OFDM and OFDM	Mitsubishi Electric
R1-1612490	SRS Transmission Aspects	Samsung
R1-1612491	SRS design for NR	Samsung
R1-1612492	QCL relations for different types of RS	Samsung
R1-1612493	QCL assumptions across antenna ports of a same RS type	Samsung
R1-1612494	Discussions on CSI-RS design for NR MIMO	Samsung
R1-1612495	DL beam management RS for multi-beam >6GHz	Samsung
R1-1612496	UL beam management RS	Samsung
R1-1612497	DMRS Design Aspects for NR	Samsung
R1-1612498	LLS results for DMRS patterns	Samsung
R1-1612499	Frequency domain pattern for RS for phase tracking	Samsung
R1-1612580	On SRS for NR	Intel Corporation
R1-1612581	Aspects of reference signal design for URLLC services	Intel Corporation
R1-1612624	Study of Time and Frequency Density of Phase Noise RS	National Instruments Corp.
R1-1612632	On UL RS for CSI Estimation	Cohere Technologies
R1-1612637	Considerations on measurement RS design for NR	InterDigital Communications

R1-1612638 Considerations on demodulation RS design for NR InterDigital Communications
R1-1612640 A common framework for RS design in UL NR InterDigital Communications
R1-1612720 Views on RS for phase tracking NTT DOCOMO, INC.
R1-1612727 Reference signal design for NR NTT DOCOMO, INC.
R1-1612839 A view on the maximum number of orthogonal DL DMRS ports for NR MU-MIMO Mitsubishi Electric Co.
R1-1612853 Dynamic CSI-RS management Nokia, Alcatel-Lucent Shanghai Bell
R1-1612854 On the reference symbol types in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612855 On the CSI reference symbols configurations in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612856 On the number of antenna ports to be supported in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612857 On the DMRS structure for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612858 Extended framework for QCL assumptions Nokia, Alcatel-Lucent Shanghai Bell
R1-1612859 On QCL Configurations in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612860 On RS Design for Phase Tracking in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612861 UL SRS design considerations in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612988 DMRS reuse for data and control Ericsson
R1-1613032 On DM-RS design for NR Intel Corporation
R1-1613105 Discussion on flexible DMRS patterns ZTE, ZTE Microelectronics
R1-1613108 WF on spatial QCL parameters for NR Intel
R1-1613122 Evaluation of CSI-RS Design for Mixed Numerology in NR AT&T GNS Belgium SPRL
R1-1613145 WF on CSI-RS Design for Mixed Numerology in NR AT&T
R1-1613152 WF on QCL assumptions in NR LG Electronics
R1-1613156 WF on CSI-RS configuration for coordinated transmission LG Electronics
R1-1613426 WF on RS for phase tracking Huawei

7.1.3.3 Beam management and CSI acquisition

Including UE reporting

R1-1611238 Consideration on interference measurement for CSI acquisition Huawei, HiSilicon
R1-1611416 Performance evaluation for beam grouping principles ZTE, ZTE Microelectronics
R1-1611676 Design for Type II Feedback Huawei, HiSilicon
R1-1611985 Reference signal and procedure for Beam Management P-1 Intel Corporation
R1-1612345 Beam management overview Ericsson
R1-1612348 Details of unified CSI feedback framework Ericsson
R1-1612514 Discussion on beam recovery mechanism Samsung
R1-1612730 CSI Acquisition Schemes for NR NTT DOCOMO, INC.
R1-1612864 Beam Management – Beam Reporting Nokia, Alcatel-Lucent Shanghai Bell
R1-1612941 Simulation Results of Beam Search Beijing Xinwei Telecom Techn.

Tuesday session

R1-1613362 WF on CSI-RS and Codebook Size for NR Ericsson, NTT DOCOMO, Huawei, LG Electronics, Nokia, ASB

- In NR, a UE can be configured with a CSI-RS resource configuration with X ports
  - Supported values of X are up to at least 32
- NR supports up to at least 32 port codebook
  - FFS: Codebook design
- Study the potential benefits of 64 ports

Decision: The document is agreed.

R1-1613176 WF on frequency granularity for CSI reporting in NR LG Electronics, NTT DOCOMO, Samsung, Intel, Nokia, Ericsson

Agreements:

- For CSI reporting for a component carrier, at least three different frequency granularities should be considered in the study
  - Wideband CSI
    - Wideband size is determined by UE RF capability of receiving DL signal.
      - Location of wideband could be configurable by network.
    - For example, used for analog beam management at least.
  - Partial band CSI
    - Alt1. UE-specifically configurable bandwidth

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- Alt2. The size is determined by the composition of numerologies or scheduling time units within the UE-specific wideband.
  - Applicable only when different numerology or scheduling time unit are multiplexed within wideband.
- For example, used for analogue beam management
- For example, used for managing CSI per service at least
- Subband CSI
  - The band size is determined by dividing wideband or partial band to multiple bands.
  - For example, used for frequency selective scheduling and subband precoding at least
- Possible down selection and/or merge of above granularities can be studied
- Combination of above frequency band CSI also needs to be studied

R1-1613143 **WF on NR CSI Acquisition** **AT&T, Samsung, NTT Docomo, Intel, Qualcomm, ZTE**
Further revised in:
R1-1613560 **WF on NR CSI Acquisition** **AT&T, Samsung, NTT Docomo, Intel, Qualcomm, ZTE, Nokia, ASB**

Agreements:

- Study the benefit of involving UE in selecting CSI report setting based on its measurement.
  - CSI report setting may include the granularity of spatial domain (e.g. rank and beam(s) selection) and frequency/time domain (e.g. wideband/subband or subband size).
    - Including of other domains are not precluded.
  - UE selection is under certain constraint configured by network. (same as LTE)
- Study UE assisted/selected CSI report setting, with the following use cases:
  - Example-1: UE may recommend the best CSI report setting/s to help network configure CSI feedback. (Network can overwrite UE's recommendation)
  - Example-2: Network can configure multiple candidate CSI report settings for UE to select, and UE indicates its selection along with CSI report (e.g. "Enhanced" RI can be used for UE to indicate its selection)
  - Others are no precluded
- Note: LTE actually support multiple types of UE selected feedback "format":
  - RI (may change the payload of the CSI)
  - CRI (may change the payload of the CSI)
  - Orthogonal beam pattern for Rel. 13 Rank 3-4 codebook (no impact on the payload of the CSI)

R1-1613445 **WF on CSI-RS and Codebook Size for NR** **Ericsson, Intel, Samsung, NTT DOCOMO, Nokia, ASB, CATT**
Wednesday: Further revised in:
R1-1613575 **WF on CSI-RS and Codebook Size for NR** **Ericsson, Intel, Samsung, Nokia, ASB, CATT, Kathrein-Werke KG, NTT DOCOMO, AT&T, Verizon Wireless, Sprint, Deutsche Telekom, Xilinx**

- For both Type I and II CSI feedback, a CSI-RS resource configuration has X ports
- For Type I, CSI feedback using a PMI codebook for X CSI-RS ports is supported
- For Type II, CSI feedback using X CSI-RS ports is supported
- Supported values of X are at least 1,2,4,8,12,16,20,24,28,32
  - Note: For X=1, Type I does not have PMI feedback
- Support for other values of X is not precluded

Discussion: Also supported by KT, Orange, Mitsubishi
ZTE→ don't believe such granulariry is needed – no need for supporting more than 8 CSI-RS ports in NR. Hybrid CSI based feedback with up to 8 CSI-RS ports is another option.
Decision: The document is noted.

Possible agreement:

- For Type I, CSI feedback using a PMI codebook for X CSI-RS ports is supported
- Supported values of X are at least 1,2,4,8,12,16,20,24,28,32
  - Note: For X=1, Type I does not have PMI feedback
- Support for other values of X is not precluded
- Note the number of ports in CSI-RS resource configuration may not be the same with the number of ports in the PMI codebook

Objected by Huawei, ZTE
Huawei compromise: remove 20, 28
ZTE compromise: 24 should also be removed
Ericsson: do not agree to have such gap between between 16 and 32

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ZTE: let's have 24 FFS

Working assumptions:

- For Type I, CSI feedback using a PMI codebook for X CSI-RS ports is supported
- Supported values of X are at least 1,2,4,8,12,16,[24],32
  - Note: For X=1, Type I does not have PMI feedback
- Support for other values of X is not precluded
- Note the number of ports in CSI-RS resource configuration may not be the same with the number of ports in the PMI codebook

R1-1611414 **On number of CSI-RS ports for NR MIMO ZTE, ZTE Microelectronics**
R1-1613278 **On port combining codebooks in Type I CSI feedback Ericsson** (Revision of R1-1612350)

R1-1613175 **WF on CSI Framework for NR Samsung, AT&T, NTT DOCOMO**

Agreements:

- A UE can be configured for CSI acquisition with the following features:
  - N≥1 CSI reporting settings, M≥1 RS settings, J≥1 IM settings, and a CSI measurement setting which links the N CSI reporting settings with the M RS settings and J IM settings
  - A CSI reporting setting includes at least the following:
    - Time-domain behavior: aperiodic or periodic/semi-persistent
    - Frequency-granularity, at least for PMI and CQI
    - FFS: Which CSI parameters are reported
      - If PMI is reported, PMI Type (Type I or II) and codebook configuration
  - An RS setting includes at least the following:
    - Time-domain behavior: aperiodic or periodic/semi-persistent
    - RS type which encompasses at least CSI-RS
    - RS resource set(s) of K resources
  - An IM setting includes at least the following:
    - Time-domain behavior: aperiodic or periodic/semi-persistent
    - IM types which encompasses CSI-IM
    - FFS: RS setting and IM setting can be merged
  - A CSI measurement setting includes at least the following :
    - One CSI reporting setting
    - One RS setting
    - One IM setting
    - For CQI, reference transmission scheme setting
- Study the possibility of configuring a UE with multiple CSI measurement settings including dynamic indication to select a preferred CSI measurement setting
  - Including selection of resource(s) out of the K resources within an RS setting
- UE supports up to L CSI measurement
  - Value of L may depend on the UE capability

Wednesday session

R1-1613287 **WF on NR NW Initiated Beam Switching Intel, Ericsson**
Also supported by CATT
Agreements:

- NR to provide robustness against beam pair link blocking
  - Study mechanisms to achieve the above purpose
    - E.g., by enabling PDCCH/PDSCH monitoring with N beams
      - E.g., N=1, 2, …
      - E.g., TDM monitoring, simultaneous monitoring, etc.
    - E.g., by enabling composite beams via e.g., SFBC and/or multi-stage control channel
    - The examples are not intended to be exhaustive

R1-1613288 **WF on NR UE requested beam switching Intel Corporation, Samsung**

R1-1613177 **WF on interference measurementLG Electronics, Intel, Ericsson, Huawei**

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- NR supports CSI calculation based on one-shot measurement of interference.
- For one-shot interference measurement, study at least one of the following alternatives:
  - Alt1. Dynamic indication of aperiodic IMR.
  - Alt2. Configuration of periodic/semi-persistent IMR with dynamic indication of interference measurement restriction.
  - Alt3. Configuration of periodic/semi-persistent IMR with semi-static configuration of interference measurement restriction.
  - Other alternatives are not precluded
  - Note that the definition of IMR (e.g., ZP CSI-RS, NZP CSI-RS, a hybrid of ZP/NZP CSI-RS, DM-RS, etc.) is a separate topic
  - Note that the connection of the above alternative(s) with measurement setting is a separate topic

R1-1613171 **WF on periodic and semi-persistent CSI reporting Samsung, NTT DOCOMO, Ericsson, LGE**

Agreements:

- For NR, support both periodic and semi-persistent CSI reporting:
  - For periodic: higher-layer configuration of reporting periodicity and timing offset
  - FFS for the case of semi-persistent CSI reporting w.r.t. reporting periodicity and timing offset
  - FFS on detailed signaling

R1-1613110 **WF on interference measurement for CSI in TDD Intel, LGE, NTT DOCOMO**

Agreement: NR to study interference measurement and reporting mechanism by capturing same-link and cross-link interference in TDD systems for both DL and UL transmissions

R1-1613542 WF on Beam Correspondence Samsung, NTT DOCOMO, InterDigital, MediaTek, Convida Wireless, Sharp

Possible agreements:

- Support indication of UE's capability on reciprocity calibration to TRP.
- Study whether or not procedure(s) for determining reciprocity calibration is needed
  - e.g. as shown in appendix
  - e.g. metrics to be considered SNR/Power (beam-quality), CSI, and others

R1-1613682 **WF on Beam Correspondence Samsung, NTT DOCOMO, InterDigital, MediaTek, Convida Wireless, Sharp**

Agreements:

- Companies are encouraged to refine the definition of beam correspondence, if necessary
  - Note: whether or not to introduce this definition in NR is a separate topic
- Under the refined definition of beam correspondence (if any), study whether or not mechanism(s) for determining UE's beam correspondence is needed.
  - the study may consider the following aspects -
    - e.g. metrics to be considered SNR/Power (beam-quality), CSI, and others
    - e.g. values of the metrics at which beam correspondence is declared
    - e.g., complexity/overhead
    - e.g., possibility of supporting reporting to the gNB about beam correspondence at the UE

R1-1613365 WF on beam management for control and data channel ZTE, ZTE Microelectronics, ASTRI, Intel

Also supported by Samsung

Possible agreements:

- For downlink control channel, NR supports beam management with and without beam-related indication
  - When beam-related indication is provided, information pertaining to UE-side beamforming/receiving procedure used for downlink control channel reception can be indicated through QCL to UE
    - FFS: Information other than QCL
- FFS: DL control and data channels share the same beam resource pool at least for beam-related indication
  - e.g. A beam resource pool is a pool of reference signal resources for beam group indication via QCL
- Study separate beam-related indication for DL control and data channels within the shared beam resource pool

R1-1613670 **WF on beam management for control and data channel ZTE, ZTE Microelectronics, ASTRI, Intel, Samsung, LGE**

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Agreements:
- NR supports with and without a downlink indication to derive QCL assumption for assisting UE-side beamforming for downlink control channel reception
  - FFS: details
    - E.g., QCL assumption details
    - E.g., indication signaling (e.g. DCI, MAC CE, RRC, etc.)
    - E.g., beam-related indication for DL control and data channels

R1-1613740 WF on Group-based Beam Management ZTE, ZTE Microelectronics, ASTRI (Revision of R1-1613366)
R1-1613725 WF on event-driven UL transmission in NR LG LG Electronics, ZTE, ZTE Microelectronics, Intel, NTT DOCOMO, Samsung, Nokia, ASB
R1-1613774 WF on UE initiated UL transmission in NR LG Electronics, Ericsson, Huawei, HiSilicon
Also supported by MTK

Agreements:
- NR should study the necessity of event-driven UE initiated UL transmission, e.g., in the event of beam quality degradation
  - E.g. due to UE mobility/rotation, blockage, and/or link failure, etc.
  - FFS: details of event(s) of beam quality degradation

R1-1613425 WF on codebook design for multi-panel based MIMO Huawei, HiSilicon, Intel

Agreement:
- Consider the impact of the antenna panel array
  - Study the impact of antenna panel array in NR CSI feedback design.
- Note: Different antenna panel may or may not be from same TRP.

R1-1613582 WF on codebook structure for NR Intel (4)
R1-1613288 WF on NR UE requested beam switching Intel Corporation, Samsung
R1-1613157 WF on beam reporting LG (5)
R1-1613589 WF on beam indication and reporting Samsung (2)
Conclusion: Discuss further till next meeting to clarify P-1/P-2/P-3 in terms of being periodic, aperiodic, etc. – Alexei (Intel)

R1-1613727 WF on beam indication and reporting Samsung, Ericsson, NTT DOCOMO, Intel, LGE, Verizon, KT
R1-1613649 WF on UL Beam Management Huawei, HiSilicon, China Unicom, Softbank, Xinwei, MTK, NTT DOCOMO
R1-1613677 WF on Unified Codebook Structure for Type I and II CSI Samsung, Intel, CATT, AT&T
R1-1613441 WF on Type I and Type II CSI feedback Huawei, HiSilicon, China Unicom

R1-1613431 WF on CSI timing for NR LG Electronics, Samsung, Ericsson
R1-1613428 WF on beam management procedure Samsung

R1-1613504 WF on CSI-RS resource pooling Ericsson, LG Electronics, Huawei, HiSilicon, Samsung

Agreements:
- Support UE specific RRC configuration of one or more CSI-RS resource sets
  - As one operation example, CSI-RS resources within a set can be dynamically shared amongst users
- Support dynamic allocation of one or more CSI-RS resources from the one or more sets to one or more users
  - Allocation can be aperiodic (single-shot)
  - Allocation can be on a semi-persistent basis
    - Note: semi-persistent CSI-RS transmission is periodic while allocated
- Study the following aspects
  - Signaling mechanism for dynamic allocation/de-allocation
    - e.g. via MAC CE or L1 control signaling, via hierarchical control signaling with MAC-CE and DCI
    - De-allocation may or may not be dynamically signaled at a later point in time
  - Signaling mechanism for slot configuration (i.e., periodicity, subframe offset like in LTE)
  - Signaling format for dynamic indication of CSI-RS resource(s)
  - Signaling overhead reduction approaches

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- 1. e.g., structured groupings of CSI-RS resources and/or allocation scheme utilizing a combination of RRC configuration and dynamic signaling
- 5. Methods to support resources of variable number of ports
  - 1. e.g. Aggregation of resources of a smaller number of ports
- 6. Note: CSI-RS can be NZP
  - 1. FFS: ZP
- 4. Note: mapping of CSI-RS resources with TRP(s) is an implementation issue

R1-1613602 **Calibration Support for Beam Correspondence** **Qualcomm, Interdigital, National Instruments, Fujitsu, Cohere**
Also supported by Facebook

R1-1613745 **WF on SRS** **Huawei, HiSilicon, Xinwei, Samsung, ATT**

R1-1611237 On the need for more flexible configurations related to CSI reporting Huawei, HiSilicon
R1-1611384 Consideration on CSI for NR MIMO CATT
R1-1611385 Discussion on beam reporting CATT
R1-1611386 Beamforming for data and control channel CATT
R1-1611387 Design of beam management procedure P3 CATT
R1-1611388 QCL between CSI-RS for beam management CATT
R1-1611389 On beam determination CATT
R1-1611415 Group based beam management ZTE, ZTE Microelectronics
R1-1611417 Beam selection and CSI acquisition for NR MIMO ZTE, ZTE Microelectronics
R1-1611418 Downloadable/Configurable Codebook for NR MIMO ZTE, ZTE Microelectronics
R1-1611419 Linear combination based CSI report for NR MIMO ZTE, ZTE Microelectronics
R1-1611420 Discussion on beamforming procedure considering high frequency channel characteristics ZTE, ZTE Microelectronics
R1-1611421 Beam management for Control Channel ZTE, ZTE Microelectronics
R1-1611422 Discussion on beam recovery mechanism ZTE, ZTE Microelectronics
R1-1611474 High level views on beam management for NR-MIMO ZTE, ZTE Microelectronics
R1-1611541 Views on beam management for NR Sony
R1-1611546 Beam Training Procedure for NR MIMO in FDD Sony
R1-1611666 Codebook design for Multi-panel structured MIMO in NR Huawei, HiSilicon
R1-1611670 Discussion on beam management aspects for DL MIMO Huawei, HiSilicon
R1-1611671 Discussion on beam management aspects for UL MIMO Huawei, HiSilicon
R1-1611674 CSI measurement and reporting for coordinated transmission scheme Huawei, HiSilicon
R1-1611675 Design for Type I Feedback Huawei, HiSilicon
R1-1611817 Views on beam management procedure LG Electronics
R1-1611818 Discussion on UL beam management LG Electronics
R1-1611819 Views on beam recovery LG Electronics
R1-1611820 On beam relationship between control channel and data channel LG Electronics
R1-1611821 Views on RS for beam management LG Electronics
R1-1611822 Discussion on CSI measurement framework LG Electronics
R1-1611823 Discussion on interference measurement and reporting LG Electronics
R1-1611824 Discussion on CSI feedback contents for NR MIMO LG Electronics
R1-1611825 Frequency granularity of NR CSI components LG Electronics
R1-1611826 Discussion on channel reciprocity for NR MIMO LG Electronics
R1-1611982 Discussion on beam recovery in NR Intel Corporation
R1-1611983 Discussion on NR codebook design Intel Corporation
R1-1611984 Further discussion on NR CSI configuration Intel Corporation
R1-1611986 Reference signal and procedure for Beam Management P-2 and P-3 Intel Corporation
R1-1611987 On uplink beam management Intel Corporation
R1-1612056 Beam management for NR Qualcomm Incorporated
R1-1612057 Discussion on CSI acquisition Qualcomm Incorporated
R1-1612058 Beam reciprocity aspects Qualcomm Incorporated
R1-1612059 Beam recovery procedures Qualcomm Incorporated
R1-1612131 Beam recovery considerations for above-6GHz MediaTek Inc.
R1-1612147 On the explicit CSI feedback MediaTek Inc.
R1-1612188 Further considerations on DL CSI acquisition framework of NR-MIMO CMCC
R1-1612189 Discussion on beam recovery for NR CMCC
R1-1612196 Views on CSI acquisition and reporting for hybrid beamforming ITRI

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R1-1612197	Discussion on beam management procedure for initial access	ITRI
R1-1612258	Further discussion on beam management and CSI acquisition	Beijing Xinwei Telecom Techn.
R1-1612346	RS for beam management	Ericsson
R1-1612347	On robust beam management	Ericsson
R1-1612349	On CSI measurements and reporting	Ericsson
R1-1612351	On Type II CSI feedback	Ericsson
R1-1612352	Further discussion on CSI-RS pooling	Ericsson
R1-1612353	On measurement restriction	Ericsson
R1-1612354	On interference estimation in NR	Ericsson
R1-1612355	Categorizing Type I and II CSI Feedback	Ericsson
R1-1612369	UE Selected Generic Format Indicator for CSI Feedback in NR	AT&T GNS Belgium SPRL
R1-1612500	CSI acquisition for DL NR MIMO	Samsung
R1-1612501	CSI acquisition for UL NR MIMO	Samsung
R1-1612502	Advanced CSI feedback for NR	Samsung
R1-1612503	Simulation results for explicit CSI reporting for NR MIMO	Samsung
R1-1612504	Codebook design framework for NR MIMO	Samsung
R1-1612505	Discussions on periodic and semi-persistent CSI reporting for NR	Samsung
R1-1612506	Discussions on aperiodic CSI reporting for NR	Samsung
R1-1612507	Discussions on channel and interference measurements for NR	Samsung
R1-1612508	Discussions on service specific CSI for NR	Samsung
R1-1612509	Discussion on DL beam management procedures P-2 and P-3	Samsung
R1-1612510	Impact of beam correspondence	Samsung
R1-1612511	Discussion on UL beam management	Samsung
R1-1612512	Discussion on Network triggered beam reporting	Samsung
R1-1612513	Discussion on beam switching mechanism	Samsung
R1-1612515	Overview on the beam management in NR	Samsung
R1-1612516	Beam management for DL control channel	Samsung
R1-1612517	Discussion on beam grouping	Samsung
R1-1612641	Considerations on Beam Recovery for NR	InterDigital Communications
R1-1612642	CSI Acquisition for NR MIMO	InterDigital Communications
R1-1612728	General Views on Beam Management	NTT DOCOMO, INC.
R1-1612729	Hybrid Beamforming for NR	NTT DOCOMO, INC.
R1-1612731	Initial investigation of the impact of UE movement	NTT DOCOMO, INC.
R1-1612732	Beam correspondence information (BCI) acquisition scheme	NTT DOCOMO, INC.
R1-1612733	Beam management with reciprocity based beam determination considering interference	NTT DOCOMO, INC.
R1-1612862	On procedures for beam selection and feedback signalling	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612863	Beam managemenet - DCI monitoring	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612865	Beam Recovery in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612866	Beam Management – Beam Reciprocity Impacts	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612867	On beam training based on periodic DL signals	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612868	Beam training based on aperiodic DL signals	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612869	DRX and Beam Management	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612870	Discussion on interfernece hyphothesis utilization in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612871	On the CSI reporting in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612872	On the CSI timing relationhips	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612873	On the channel and interference estimation in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612928	On Beam management procedures	CEWiT
R1-1613110	WF on interference measurements for CSI in TDD	Intel
R1-1613142	WF on NR MIMO CSI Feedback Framework	AT&T
R1-1613157	WF on beam reporting in NR	LG Electronics
R1-1613171	WF on periodic and semi-persistent CSI reporting	Samsung
R1-1613177	WF on interference measurement in NR	LG Electronics
R1-1613187	WF on beam correspondence information acquisition	NTT DOCOMO
R1-1613278	On port combining codebooks in Type I CSI feedback	Ericsson
R1-1613286	WF on codebook structure for NR	Intel
R1-1613287	WF on NR NW Initiated Beam Switching	Intel
R1-1613288	WF on NR UE Requested Beam Switching	Intel
R1-1613289	WF on interference measurements for CSI in TDD	Intel
R1-1613365	Way Forward on beam management for control and data channel	ZTE
R1-1613366	Way Forward on on Group-based Beam Management	ZTE
R1-1613425	WF on codebook design for multi-panel based MIMO	Huawei
R1-1613427	WF on Unified Codebook Structure for Type I and II CSI	Samsung
R1-1613428	WF on Beam management procedure	Samsung
R1-1613431	WF on CSI timing for NR	LG Electronics

R1-1613434 WF on CSI measurement and reporting for coordinated transmission Huawei
R1-1613441 WF on Type 1 CSI feedback Huawei
R1-1613442 WF on Type II CSI feedback Huawei

7.1.3.4 Other

Including MIMO calibration issues

R1-1613104 Summary of [86b-19] email discussion on Phase 2 MIMO calibration for NR ZTE, ZTE Microelectronics(Revision of R1-1611423)
Companies are encouraged to check the proposals in R1-1613104. Revisit later this week.
Thursday
R1-1613741 Way forward on Phase 1 and Phase 2 MIMO calibration for NR ZTE (Revision of R1-1613718)
Conclusion: All proposals in R1-1613741 are endorsed

R1-1613744 NR-MIMO Phase-1 Calibration Results ZTE, ZTE Microelectronics
Conclusion:
1. The spreadsheet in R1-1613744 containing the results is endorsed
2. Email (till next meeting) to collect additional phase 1 and phase 2 simulation results and clarify simulation assumptions, if any – Ruyue (ZTE)

R1-1611677 Further discussion of UL power control for NR Huawei, HiSilicon
R1-1612876 Power control for MIMO Nokia, Alcatel-Lucent Shanghai Bell

R1-1613724 WF on UL TPC NTT DOCOMO, CATT, Huawei, HiSilicon, Samsung

Agreements:
1. For NR-PUSCH at least targeting eMBB,
    1. Open-loop power control based on pathloss estimate is supported.
        1. Pathloss is estimated using DL RS for measurement
        2. Fractional power control is supported
        3. FFS: Which DL RS(s) for measurement is used (The RS may be beamformed).
    2. Closed-loop power control is supported, which is based on NW signaling.
        1. Dynamic UL-power adjustment is considered
2. Further study on:
    1. Numerology specific power control
        1. e.g. numerology specific power control parameters
    2. Beam specific power control parameters
    1. Power control for other RSs and physical channels
    2. Power control for grant free PUSCH if supported
    3. Power control per layer (group)

R1-1611423 Summary of [86b-19] email discussion on Phase 2 MIMO calibration for NR ZTE, ZTE Microelectronics
R1-1611424 Results of Phase 1 calibration for NR MIMO ZTE, ZTE Microelectronics
R1-1611425 Further clarification on assumptions for Phase 1 NR-MIMO calibration ZTE, ZTE Microelectronics
R1-1611477 Phase 1 system level calibration results Spreadtrum Communications
R1-1611827 Phase I SLS calibration results for NR MIMO LG Electronics
R1-1611828 Phase II SLS calibration results for NR MIMO LG Electronics
R1-1611829 Phase I LLS calibration results for NR MIMO LG Electronics
R1-1611830 Phase II LLS calibration results for NR MIMO LG Electronics
R1-1611831 Discussion on UL power control for NR LG Electronics
R1-1611988 On uplink power control for NR Intel Corporation
R1-1612060 Phase 1 calibration results for sub6GHz and Phase 2 calibration assumptions Qualcomm Incorporated
R1-1612061 Phase 1 calibration results for above 6GHz and Phase 2 calibration assumptions Qualcomm Incorporated
R1-1612129 Phase 1 LLS Calibration Results for NR MIMO MediaTek Inc.
R1-1612259 NR MIMO system level calibration results Beijing Xinwei Telecom Techn.
R1-1612260 NR MIMO link level calibration results Beijing Xinwei Telecom Techn.
R1-1612356 On power control in NR and MU-MIMO Ericsson
R1-1612518 UL Power Control Aspects Samsung

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R1-1612519 MIMO LLS calibration results for NR on 4GHz frequency band Samsung
R1-1612521 MIMO LLS phase 2 calibration results for NR on 30GHz frequency band Samsung
R1-1612523 MIMO SLS phase 2 calibration results for NR on 30GHz frequency band Samsung
R1-1612711 Views on UL transmit power control for NR NTT DOCOMO, INC.
R1-1612734 MIMO calibration results NTT DOCOMO, INC.
R1-1612750 Phase I calibration results of NR MIMO CATT
R1-1612874 On-demand power boost and cell muting for URLLC in the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1612875 Latency assumptions for network-based coordination studies Nokia, Alcatel-Lucent Shanghai Bell
R1-1612888 UL power control in multi-beam based approaches ASUSTEK COMPUTER (SHANGHAI)
R1-1613100 Discussion on MIMO calibration Huawei, HiSilicon
R1-1613115 Phase 1 NR MIMO calibration results Ericsson LM
R1-1613383 MIMO LLS phase 1 calibration results for NR on 30GHz frequency band Samsung
R1-1613384 MIMO SLS phase 1 calibration results for NR on 30GHz frequency band Samsung

7.1.4 Scheduling/HARQ aspects

R1-1612710 Consideration on wider BW operation for NR NTT DOCOMO, INC.

- Proposal 1: Consider multiple PSS/SSS transmissions in an NR carrier with a wider NW channel bandwidth and strive to minimize the effort on initial access from UE perspective.
- Proposal 2: Consider also implementation-based approach to single PSS/SSS transmission in an NR carrier for the case when the UE channel BW is narrower than the NW channel BW
- Proposal 3: The following aspects for NR carrier aggregation/dual connectivity should be reused from the LTE.
  - Cross-carrier scheduling and joint UCI feedback for the single numerology scenario
  - TB mapping per NR carrier
  - UL TPC for the single numerology scenario
- Proposal 4: The following aspects should be considered for NR carrier aggregation/dual connectivity in Phase 1.
  - Intra-TRP and inter-TRP with ideal and non-ideal backhaul scenarios are targeted.
  - For non-stand-alone operation, the PBCH and system information don't need to be transmitted from all the NR carriers and other channels are configurable when needed.
- Proposal 5: The following aspects should be further studied for NR carrier aggregation/dual connectivity in Phase 1.
  - Number of carriers
  - TB mapping across NR carriers
  - Carrier on/off switching mechanism
  - Different numerologies between different/same carrier(s) for a given UE

Decision: The document is noted.

R1-1613218 WF on UE bandwidth adaptation in NR MediaTek, Acer, AT&T, CHTTL, Ericsson, III, InterDigital, ITRI, NTT Docomo, Qualcomm, Samsung, Verizon

- For single carrier operation, NR should allow UE-specific RF bandwidth adaptation for UE operations in DL (e.g. DL reception, measurements) and UL transmission
  - UE-specific RF bandwidth adaptation for UL is not necessarily coupled with that for DL
  - FFS detailed mechanism
- Send LS to RAN4 to study the feasibility of UE RF bandwidth adaptation for single carrier operation and its corresponding transition time
  - Consider the cases shown in the appendix

Discussion: Nokia commented that RAN4 should study first before agreeing such WF
Decision: The document is noted.

Agreements:

1. Send LS to RAN4 to study the following points for single/multi-carrier operation
   1. How fast is the UE RF bandwidth adaptation
   2. How much power saving is possible for UE RF bandwidth adaptation
   3. Other benefits
   4. Whether any of the above depends on the conditions, such as
      1. Whether or not first and second RF bandwidth are centered at the same frequency
      2. Whether or not first RF bandwidth are partially or fully contained in the second RF bandwidth
      3. The ratio of first and second RF bandwidth
      4. Whether or not first and second RF bandwidth are in the same band
      5. Dependency of modulation scheme
      6. Whether or not neighbor cell synchronization signals are within first RF bandwidth
      7. Whether or not first and/or second RF bandwidth are centered at the same frequency as neighbor cell synchronization signals

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8. Whether or not additional reference signals are needed, for example for AGC settling
9. Whether it depends on transmission direction

2. LS includes corresponding agreements/WA for DL control in past meetings
    1. Note: RAN1 is under discussion on RF bandwidth adaptation for DL data and UL control/data

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R1-1613659 Draft LS on UE RF Bandwidth Adaptation in NR Mediatek
Agreed in R1-1613663

7.1.4.1 *Physical downlink control channel*

R1-1612908 Summary of E-mail discussions on downlink control signaling Ericsson
The document was presented by Stefan Parkvall from Ericsson.
Decision: The document is noted.

Agreements:
- The time/freq. resource containing at least one search space is obtained from MIB/system information/implicitly derived from initial access information
- Time/freq. resource containing additional search spaces, can be configured using dedicated RRC signaling
- Other solution is not precluded

Agreements:
- The reference signals in at least one search space do not depend on the RNTI or UE-identity
    - FFS: The reference signals in at least an additional search space do not depend on the RNTI or UE-identity
- FFS: For one UE, there is the case the channel estimate obtained for one RE is reusable across multiple blind decodings involving that RE
- In an additional search space, reference signals can be configured, FFS: explicitly or implicitly

Possible working assumption:
- At least for single-stage design, a DCI message is transmitted in one control subband in the frequency domain
    - Note: Consider means to ensure sufficient frequency diversity, e.g. sufficiently wide control subband, distributed RBs for one control channel candidate in the control subband, etc.
    - PRBs for control subband can be contiguous or non-contiguous in the frequency domain

Continue offline discussion until Tuesday – (Ericsson)

R1-1611656 Summary of email discussion [86b-23] on DL control channel design Huawei, HiSilicon
The document was presented by David Mazzarese from Huawei.
Decision: The document is noted. Continue offline discussion until Tuesday – (Huawei)

Tuesday session
R1-1613311 Summary of offline discussion on DL control channels Ericsson
The document was presented by Stefan Parkvall from Ericsson.
Decision: The document is noted, and the following is agreed:

Agreements:
- At least for single-stage DCI design:
    - A control resource set (formerly called control subband) is, in the frequency domain, a set of PRBs within which the UE attempts to blindly decode downlink control information
        - The PRBs may or may not be frequency contiguous
        - A UE may have one or more control resource sets
        - Working assumption: One DCI message is located within one control resource set
- In frequency-domain, a PRB is the resource unit size (may or may not including DM-RS) for control channel

Agreements:
- NR should support dynamic reuse of at least part of resources in the control resource sets for data for the same or a different UE, at least in the frequency domain
    - FFS if resource reuse can be done in time domain as well
    - FFS: DL data DM-RS location in time should not vary dynamically as a consequence of dynamic reuse of control resources for data
    - FFS: time/frequency granularity of the resource reuse
    - FFS: signaling needed, if any

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R1-1611211 **Discussion on search space design for DL control channels Huawei, HiSilicon**

- *Proposal 1: Both UE-specific search space and common search space are supported in NR.*
- *Proposal 2: UE-group-specific search space in NR can be further studied.*
- *Proposal 3: Common search space is defined within at least one predefined or semi-statically configured control subband in a carrier.*
- *Proposal 4: UE-specific search space is configured either dynamically or semi-statically.*

Decision: The document is noted.

R1-1613023 **On the transmission of DL control information and data using different numerologies Nokia, Alcatel-Lucent Shanghai Bell**

- *Observation #1: Dynamic scheduling of multiple numerologies increases PDCCH blind detection burden at UE*
- *Observation #2: With RF beamforming, multiple short PDCCH symbols increases the PDCCH capacity compared to the case with one longer PDCCH symbol.*
- *Observation #2: From performance point of view, it is feasible to have larger subcarrier spacing for control compared to that of data.*
- *Proposal #1: Consider different numerologies for control and data as an enabler for dynamic scheduling between multiple numerologies, and for improved PDCCH capacity in the case of RF beamforming.*

Decision: The document is noted.

R1-1613668 **WF on two stage DCI design Huawei, HiSilicon, Qualcomm, OPPO, Convida, ZTE, Fujitsu, Mediatek, InterDigital, Intel**

R1-1613091 **WF on CCE for NR DL Control ZTE, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic, Huawei,**

R1-1613720 **Summary of offline discussion on DL control channels Ericsson**

Agreements:

- ~~1.~~• when the control resource set spans multiple OFDM symbols, NR support a control channel candidate to be mapped to multiple OFDM symbols or to a single OFDM symbol
  - ~~1.~~0 The gNB can inform UE which control channel candidates are mapped to each subset of OFDM symbols in the control resource set. FFS: details of the signaling (implicit or explicit)

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R1-1613737 **WF on L1 broadcast control channel Qualcomm, MTK, Huawei. HiSilicon, ZTE, ZTE Microelectronics, Samsung, Convida,**

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611704	Downlink control channel design consideration	Guangdong OPPO Mobile Telecom.
R1-1612715	DL control channel design for NR	NTT DOCOMO, INC.
R1-1612527	Transmission Schemes for DL Control Channels	Samsung
R1-1612912	On downlink control channel duration	Ericsson
R1-1612190	DCI contents for NR-PDCCH	CMCC
R1-1611649	Numerology for DL control channel	Huawei, HiSilicon
R1-1613023	On the transmission of DL control information and data using different numerologies	Nokia, Alcatel-Lucent Shanghai Bell
R1-1612119	On UE-specific bandwidth adaptation for single carrier operation	MediaTek Inc.
R1-1612069	WF on evaluation for wake-up signal	Qualcomm Incorporated
R1-1611202	DL Control channels for CA and DC	Huawei, HiSilicon
R1-1611207	DL control channel structures	Huawei, HiSilicon
R1-1611208	Discussion on transmission schemes of DL control channel	Huawei, HiSilicon
R1-1611209	Demodulation RS design for DL control channel	Huawei, HiSilicon
R1-1611210	Time and frequency resources for DL control channels	Huawei, HiSilicon
R1-1611292	NR DL control channel structure	ZTE, ZTE Microelectronics
R1-1611390	NR DL control channel structure	CATT
R1-1611391	Common control signaling for NR	CATT
R1-1611392	Design principles of DCI formats	CATT
R1-1611393	Initial views on DL control search space	CATT
R1-1611708	Discussion on Common Control Channel for NR	ZTE Corporation

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R1-1611721 DL Control Channel Design for NR NEC
R1-1611832 Discussions on the contol channel design for NR LG Electronics
R1-1611833 Discussions on data and control multiplexing for NR LG Electronics
R1-1611834 Discussions on the reference signal for NR control channel LG Electronics
R1-1611835 Discussion on resource unit for control channel LG Electronics
R1-1611836 Discussion on different numerology for DL control and DL data LG Electronics
R1-1611837 Discussion on CSS and USS in NR system LG Electronics
R1-1611838 Discussion on Dynamic Bandwidth Adaptation LG Electronics
R1-1611839 On DCI design for NR LG Electronics
R1-1611989 Energy-efficient physical control channel reception in NR Intel Corporation
R1-1611990 On the number of OFDM symbols for NR DL control channel Intel Corporation
R1-1611991 NR downlink control channel and DMRS design Intel Corporation
R1-1612062 Control channel for slot format indicator Qualcomm Incorporated
R1-1612063 Single-part/Multi-part PDCCH Qualcomm Incorporated
R1-1612064 Subband PDCCH with broadcast/unicast Qualcomm Incorporated
R1-1612065 UE power saving for PDCCH monitoring Qualcomm Incorporated
R1-1612066 Methodology for UE DOU analysis Qualcomm Incorporated
R1-1612067 Evaluation of frame structure design for UE power consumption Qualcomm Incorporated
R1-1612068 UE Power Evaluation for DRX with Wake-Up Signaling Qualcomm Incorporated
R1-1612070 Adaptive BW for Control and Data Qualcomm Incorporated
R1-1612120 DL control channel design for NR MediaTek Inc.
R1-1612166 On the NR control subband Intel Corporation
R1-1612220 Discussion on NR DL control channel structure ETRI
R1-1612231 DL control channel design Panasonic Corporation
R1-1612235 On the DL control channel structure for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612236 On the DL control channel DM-RS design for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612237 On the transmission of DL control information and data using different numerologies Nokia, Alcatel-Lucent Shanghai Bell
R1-1612312 Downlink control channel framework for NR INTERDIGITAL COMMUNICATIONS
R1-1612371 Two Stage Control Channel Design for NR and Its Benefits AT&T GNS Belgium SPRL
R1-1612524 DL Control Channel Design Samsung
R1-1612525 DL Common Control Signaling Samsung
R1-1612526 DL Control Channel Monitoring for UE Power Savings Samsung
R1-1612625 Consideration on DL control signaling for NR Beijing Xiaomi Mobile Software
R1-1612629 Forward Compatibility Aspects of NR Control Channel Cohere Technologies
R1-1612644 Blocking probability of control channel for URLLC InterDigital Communications
R1-1612716 Monitoring of DL control channel for NR NTT DOCOMO, INC.
R1-1612717 Discussion on multiple-step DCI for NR NTT DOCOMO, INC.
R1-1612891 Time Domain Structure of DL Physical Control Channel for NR Sony
R1-1612909 On blind detection of downlink control channels Ericsson
R1-1612910 On broadcasted control channels Ericsson
R1-1612911 On DM-RS for downlink control channels Ericsson
R1-1612913 On downlink control signaling Ericsson
R1-1612914 On multi-stage DCI Ericsson
R1-1612915 On link-budget of NR PDCCH Ericsson
R1-1613014 Beam-centric Downlink Control Channel Convida Wireless LLC
R1-1613019 Discussion on Control Region Configuration in Time Domain LG Electronics Inc.
R1-1613030 Performance Evaluation of DL Control Channels Samsung
R1-1613090 WF on OFDM symbol duration for NR DL Control ZTE, ZTE Microelectronics
R1-1613091 WF on CCE for NR DL Control ZTE, ZTE Microelectronics
R1-1613163 On PDCCH scheduling Ericsson
R1-1613314 WF on common control resource set and tracking Qualcomm, ZTE
R1-1613336 WF on UL grant-free for URLLC ZTE, ZTE Microelectronics
R1-1613337 WF on Uplink URLLC and eMBB multiplexing ZTE, ZTE Microelectronics

7.1.4.2 Physical uplink control channel

R1-1613162 Summary of e-mail discussions on uplink control signaling Ericsson (Revision of R1-1612916)
The document was presented by Stefan Parkvall from Ericsson.
Decision: The document is noted.

Agreements:

- Physical uplink control signaling should be able to carry at least hybrid-ARQ acknowledgements, CSI reports (possibly including beamforming information), and scheduling requests
- Support 'UCI on PUSCH', i.e. using some of the scheduled resources for UCI in case of simultaneous UCI and data
- Support 'simultaneous PUSCH and PUCCH at least for the long PUCCH format', i.e. transmit uplink control on PUCCH resources even in presence of data
- At least a low PAPR/CM design should be supported for the 'long PUCCH'
- A combination of semi-static configuration and (at least for some types of UCI information) dynamic signaling is used to determine the PUCCH resource both for the 'long and short PUCCH formats'
- It should be possible to dynamically indicate (at least in combination with RRC) the timing between data reception and hybrid-ARQ acknowledgement transmission as part of the DCI.

Agreements:

- Support FDM of 'short UCI' and data, both within a UE and between UEs at least for the case where the PRBs for short UCI and data are non-overlapping
- FFS: PUSCH in the short UL duration can be scheduled independently

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Tuesday: Following lunch time offline

R1-1613349 Summary of offline discussion on UL control channels Ericsson

The document was presented by Stefan Parkvall from Ericsson.

Decision: The document is noted.

R1-1611843 Design of short duration UL control channel for NR LG Electronics

- Proposal 1: Following design alternatives are to be considered for multi-symbol UL control channel.
  - Alt. 1: Repetition of one-symbol UL control channel structure over multiple symbols
  - Alt. 2: TDM between RS and UCI
    - Alt. 2-1: RS is located in the first symbol.
    - Alt. 2-2: RS is located in the fixed symbol (e.g., second last symbol within a slot).
- Proposal 2: Consider short duration UL control channel around first transmitted UL symbols in a slot.
- Proposal 3: Consider multiplexing between UL control channels having different duration (with different number of symbols) within UL control region.

Decision: The document is noted.

R1-1611998 Scheduling request design for NR Intel Corporation

- Proposal 1
  - *For NR, SR can be transmitted using on/off signalling mechanism.*
  - *SR can be combined with other UCI feedback, where 1 bit information with positive or negative SR can be explicitly included in NR PUCCH.*
- Proposal 2: *SR resource allocation mechanism should be investigated with considerations of deployment scenarios and duplex modes for NR.*
- Proposal 3: *BSR transmission via NR PUCCH should be considered for low latency uplink transmission.*
- Proposal 4: *SR can be used to request resource for uplink data transmission using a numerology different from the pre-configured one.*
- Proposal 5: *For non-standalone deployment scenario, SR via LTE anchor cell can be used to request resource for uplink transmission in NR booster cell.*

Decision: The document is noted.

R1-1612533 Scaled Numerology for UL control channels Samsung

- Observation 1: BLER performance of Scheme A will be less than or equal to Scheme B in case that same DMRS overhead is assumed for both schemes when back-off gain of Scheme B is taken into account.
- Observation 2: BLER performance of Scheme A will be better than or equal to Scheme B in case that different DMRS overhead is assumed for each scheme when back-off gain of Scheme B is taken into account.
- Proposal: Investigate scaled numerology for NR UL control channel further with consideration of DMRS overhead.

Decision: The document is noted.

R1-1612073 UL channelization in short UL duration Qualcomm Incorporated

- Proposal 1: The short UL duration can consist of at least two half-symbols depending on numerology.
  - DMRS for PUCCH is transmitted in the first half-symbol, while UCI content is transmitted in the second half-symbol.
- Proposal 2: The waveform for PUCCH in short UL duration is DFT-S-OFDM.
- Proposal 3: For simultaneous PUCCH and PUSCH from the same UE, consider either piggyback PUCCH in PUSCH, or transmit PUCCH in adjacent RBs with PUSCH.

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- Proposal 4: For a UE with simultaneous PUCCH and SRS, UE may drop/delay SRS.

Decision: The document is noted.

R1-1612920 On multiplexing of short UCI and data Ericsson

Ericsson→ no need to present this particular paper – covered during email discussion

Decision: The document is noted.

Thursday session

R1-1613349 Summary of offline discussion on UL Control Channels Ericsson

R1-1613636 WF on PUCCH channelization Huawei, HiSilicon, CATT, CMCC, ERICSSON, MediaTeK, Nokia, ASB, NTT DOCOMO, OPPO, Panasonic, Vivo, Xiaomi, Xinwei

- A UCI carried by long duration UL control channel can be transmitted in one slot or multiple slots
  - Transmission across multiple slots should allow at least a total duration of 1 ms
  - FFS the numbers of the slots

Decision: The document is noted, modified as follows:

Agreements:

1. A UCI carried by long duration UL control channel at least with low PAPR design can be transmitted in one slot or multiple slots
   1. Transmission across multiple slots should allow a total duration of [1] ms at least for some cases
      1. FFS: more than [1] ms at least for some cases
   2. FFS the numbers of the slots

R1-1613721 Summary of offline discussion on UL control channel s Ericsson

Agreements:

2. In order to support TDM of short PUCCH from different UEs in the same slot, a mechanism to tell the UE in which symbol(s) in a slot to transmit the short PUCCH on is supported at least above 6 GHz (exact mechanism FFS)

R1-1613411 WF on Long Duration PUCCH LG Electronics, Intel, Samsung, NTT DOCOMO

Agreements:

3. For UL control channel with long duration, TDM between RS and UCI is supported at least for DFT-S-OFDM
   1. FFS on location of RS symbol(s) (e.g., front-loaded RS, fixed-location RS)

R1-1613632 WF on position of UL control symbol ZTE, Intel, Samsung, InterDigital, Sony

The document was presented by … from …

Discussion:

Decision: The document is noted.

R1-1611212	UL control channel design	Huawei, HiSilicon
R1-1611213	Signalling design for UL control resource in NR	Huawei, HiSilicon
R1-1611215	Multiplexing of UL control channel and SRS in NR	Huawei, HiSilicon
R1-1611216	Demodulation RS design for UL control channel	Huawei, HiSilicon
R1-1611217	Discussion on UCI types in NR	Huawei, HiSilicon
R1-1611291	NR UL control channel structure	ZTE, ZTE Microelectronics
R1-1611394	NR UL control channel structure	CATT
R1-1611395	UCI Handling for NR	CATT
R1-1611650	Numerology for UL control channel	Huawei, HiSilicon
R1-1611653	UL Control channels for CA and DC	Huawei, HiSilicon
R1-1611663	UCI multiplexing on data channel	Huawei, HiSilicon
R1-1611698	Discussion on uplink control channel	Guangdong OPPO Mobile Telecom.
R1-1611699	Multiplexing of UCI and UL data	Guangdong OPPO Mobile Telecom.
R1-1611705	Waveform selection for uplink control signal	Guangdong OPPO Mobile Telecom.
R1-1611840	Overall structure of UL control channel for NR	LG Electronics
R1-1611841	Multiplexing between UL control and data for NR	LG Electronics
R1-1611842	Design of one-symbol UL control channel for NR	LG Electronics
R1-1611844	Design of long duration UL control channel for NR	LG Electronics
R1-1611894	Discussion on uplink control channel for NR	Panasonic Corporation

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R1-1611992 UL control channel at the start of a UL part Intel Corporation
R1-1611993 UCI contents and UL control channel formats Intel Corporation
R1-1611994 UL control channel design with short duration Intel Corporation
R1-1611995 UL control channel design with long duration Intel Corporation
R1-1611996 Payload size consideration for UL control channel with short duration Intel Corporation
R1-1611997 Resource allocation for NR uplink control channel Intel Corporation
R1-1611999 UCI embedding onto UL data channels Intel Corporation
R1-1612071 Common short UL burst for delay sensitive control and data Qualcomm Incorporated
R1-1612072 UCI content Qualcomm Incorporated
R1-1612074 UL channelization in long UL duration Qualcomm Incorporated
R1-1612075 UL waveform configuration Qualcomm Incorporated
R1-1612138 On contention-based SR and uplink data transmission MediaTek Inc.
R1-1612139 Discussion on design of PUCCH in NR MediaTek Inc.
R1-1612140 Multiplexing of PUCCH and other channels MediaTek Inc.
R1-1612191 Further considerations on UL control channel CMCC
R1-1612221 Design considerations for UL control channel ETRI
R1-1612238 On the PUCCH sctructure for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612239 UCI multiplexing in the presence of UL data Nokia, Alcatel-Lucent Shanghai Bell
R1-1612240 DFT-S-OFDMA impacts in the NR UL design Nokia, Alcatel-Lucent Shanghai Bell
R1-1612376 On common UL control design between DFT-S-OFDM and OFDM Mitsubishi Electric
R1-1612529 UL Control Channel Design Samsung
R1-1612530 UCI and Data Multiplexing Samsung
R1-1612531 UCI Contents Samsung
R1-1612532 Performance Evaluation of UL Control Channels Samsung
R1-1612645 A common framework for control channel design for NR InterDigital Communications
R1-1612718 UL control channel for NR NTT DOCOMO, INC.
R1-1612747 Discussion on UCI transmission in NR Motorola Mobility
R1-1612917 On DM-RS and short UCI Ericsson
R1-1612918 On long UCI with simultaneous data transmission Ericsson
R1-1612919 On long UCI without simultaneous data transmission Ericsson
R1-1613150 WF on UL control channel mapping LG Electronics
R1-1613411 WF on long duration PUCCH LG Electronics
R1-1613412 WF on UL control channel for NR LG Electronics
R1-1613448 WF on short duration UL control for NR LG Electronics

7.1.4.3 DL/UL data scheduling procedure

Including scheduling and HARQ procedure

R1-1612313 HARQ feedback for downlink INTERDIGITAL COMMUNICATIONS
R1-1612076 Number of HARQ processes Qualcomm Incorporated
R1-1612242 On the Number of HARQ Processes Nokia, Alcatel-Lucent Shanghai Bell
R1-1611662 Scheduling scheme for slot aggregation Huawei, HiSilicon
R1-1612137 Discussion on throughput enhancement with multiple HARQ-ACK/NACK bits per TB MediaTek Inc.
R1-1612243 Enriched feedback for adaptive HARQ Nokia, Alcatel-Lucent Shanghai Bell
R1-1612001 Remaining details of signaling support for reserved resources Intel Corporation
R1-1611200 On multiple carrier operation Huawei, HiSilicon
R1-1611201 On TB mapping for CA Huawei, HiSilicon
R1-1611206 Signalling design for reserved resource indication Huawei, HiSilicon
R1-1611218 Discussion on timing relations and signaling of HARQ timing for NR Huawei, HiSilicon
R1-1611290 HARQ timing and resource of PUCCH ZTE, ZTE Microelectronics
R1-1611293 NR DCI design and procedure ZTE, ZTE Microelectronics
R1-1611295 Two-level UL grant/scheduling mechanism ZTE, ZTE Microelectronics
R1-1611396 NR Scheduling procedure CATT
R1-1611397 NR HARQ operation CATT
R1-1611399 UL grant-free transmission for eMBB CATT
R1-1611400 Discussion on UL grant-free transmission CATT
R1-1611661 Discussion on resource allocation and indication on NR Huawei, HiSilicon
R1-1611702 On DL HARQ for NR Guangdong OPPO Mobile Telecom.
R1-1611845 Discussion on HARQ timing and resource for NR LG Electronics
R1-1611846 Discussion on scheduling in time domain for NR LG Electronics
R1-1611847 Discussion on potential HARQ operation for NR LG Electronics
R1-1611848 Discussion on support of CA operation for NR LG Electronics
R1-1611896 Zero Wait Time Scheduling Request Underlay Channel Idaho National Laboratory

R1-1612000 Scheduling and DL/UL configuration in wide channel bandwidth Intel Corporation
R1-1612002 Discussion on the data scheduling for NR Intel Corporation
R1-1612077 DL processing time consideration Qualcomm Incorporated
R1-1612078 UL processing time consideration Qualcomm Incorporated
R1-1612121 On 2-stage downlink control information for NR MediaTek Inc.
R1-1612232 Timing relation dependency to slots transmission direction indication method Panasonic Corporation
R1-1612241 On HARQ/scheduling timing and self-contained operation Nokia, Alcatel-Lucent Shanghai Bell
R1-1612244 HARQ operation for large transport block sizes Nokia, Alcatel-Lucent Shanghai Bell
R1-1612245 HARQ Pooling for Carrier Aggregation in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612314 Downlink scheduling using slots and mini-slots INTERDIGITAL COMMUNICATIONS
R1-1612315 Bandwidth adaptation in NR INTERDIGITAL COMMUNICATIONS
R1-1612534 DCI Formats and ContentsSamsung
R1-1612623 DL HARQ and UL scheduling timing in NR Sharp
R1-1612646 On multiplexing of eMBB and URLLC data InterDigital Communications
R1-1612719 Scheduling and HARQ aspects for NR NTT DOCOMO, INC.
R1-1612757 Reduced HARQ timing for NR HTC Corporation
R1-1612798 Scheduling considerations for dynamic resource sharing among numerologies in NR PANASONIC
R1-1612921 On timing of uplink hybrid-ARQ acknowledgement Ericsson

7.1.4.4 URLLC specific aspects

R1-1611221 Control channel design for URLLC Huawei, HiSilicon

- *Observation 1: The reliability requirement for the DL assignment should exceed 99.999% in order to support single shot transmission.*
- *Observation 2: The requirement of NACK to ACK error is dependent on data channel reliability.*
- *Proposal 1: Strive for a reliable and spectrum efficient DL control channel considering the following three options*
  - *Opt 1: Reduce the DCI payload size*
  - *Opt 2: Allocate more time-frequency resources*
  - *Opt 3: Exploit the multi-path diversity, e.g. spatial/frequency/carrier*
- *Proposal 2: A compact DCI format can be considered targeting URLLC where a set of condensed scheduling information is conveyed.*
- *Proposal 3: A split DCI format design can be considered for URLLC.*

Decision: The document is noted.

R1-1612003 Downlink URLLC transmission and multiplexing with eMBB Intel Corporation

- Proposal 1
  - *DL mini-slot with flexible duration is supported.*
  - *Scheduling granularity less than 7 symbols slot duration is supported for 60 kHz SCS.*
  - *Further study support of 1 symbol mini-slot duration for the case of 15 kHz SCS.*
- Proposal 2: *Strive for solutions that minimize eMBB UE complexity when eMBB is multiplexed with URLLC services.*
- Proposal 3: *Strive for common solutions to handle intra-cell preemption and inter-cell time-selective interference due to multiplexing of eMBB and URLLC.*

Decision: The document is noted.

R1-1612079 HARQ design for URLLC Qualcomm Incorporated

- *Observation 1: Adaptive HARQ provides significant gains over one-shot and non-adaptive HARQ schemes in terms of spectral efficiency.*
- *Observation 2: Adaptive HARQ naturally leads to asynchronous CQI in the form of extended/super ACK, where receiver informs transmitter of instantaneous channel conditions either explicitly (i.e., CQI report) or implicitly (i.e., required bandwidth, MCS, etc.)*
- *Observation 3: Adaptive HARQ's gain over non-adaptive HARQ increases under bursty interference.*
- *Observation 4: The channel coding scheme has to be sufficiently flexible to allow the rateless HARQ operation. Specifically, it should allow a fine granularity of channel coding rates to allow the user device to transmit continuously until the ACK is received.*
- *Proposal 1: NR should support adaptive HARQ with asynchronous CQI for URLLC.*
- *Proposal 2: NR should support rateless HARQ for URLLC.*

Decision: The document is noted.

Wednesday session

R1-1613517 WF on grant-free support for UL URLLCHuawei, HiSilicon, NTT Docomo, Vodafone, Ericsson, Nokia, CATR, CATT, Spreadtrum, Fujitsu, InterDigital, OPPO, Convida Wireless, ZTE

- An UL transmission scheme without scheduling request and grant is supported for URLLC
  - Resource can be shared among one or more users

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- FFS: resource configuration details
- FFS: which specific mechanisms to resolve resource collision
- FFS other details of design

Discussion: Also supported by Sharp
Decision: The document is noted, modified as follows:

Agreements:
- At least an UL transmission scheme without grant is supported for URLLC
  - Resource may or may not be shared among one or more users
    - FFS: resource configuration details
  - FFS other details of design

Thursday session

R1-1613596 WF on UL grant-free for URLLC ZTE, ZTE Microelectronics, Huawei, Hisilicon, CATR, Convida Wireless, III, InterDigital

- For UL URLLC
  - Contention-based transmission scheme without grant is supported
  - For physical resource configuration
    - Opt. 1: randomly selected by each UE from the pre-defined resource pool(s)
    - Opt. 2: pre-configured by base station
    - Other options are not precluded
    - Combination of different options is not precluded
  - Companies are encouraged to propose specific mechanism and evaluation to solve resource collision, e.g. Interference cancellation, HARQ

Decision: The document is noted.

R1-1613532 WF on HARQ support for UL URLLC Huawei, HiSilicon, NTT Docomo, Nokia, Oppo, InterDigital, Fujitsu, CATR, Spreadtrum, CATT, Intel, ZTE

- For an UL URLLC transmission scheme without grant, HARQ/retransmission is supported
  - FFS retransmissions are also without grant and/or triggered by grant
  - FFS if retransmissions are based on A/N feedback or not
  - FFS if adaptive HARQ/retransmission is needed and possible mechanisms

Decision: The document is noted. Also supported by Ericsson, ETRI

R1-1613578 WF on URLLC HARQ support in DL Intel, Huawei, HiSilicon

Agreement: Asynchronous and adaptive HARQ is supported for DL

R1-1613641 WF on URLLC UL transmission LG, Intel

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611219	Overview of DL URLLC Support in NR	Huawei, HiSilicon
R1-1611220	Overview of UL URLLC Support in NR	Huawei, HiSilicon
R1-1611222	DL URLLC multiplexing considerations	Huawei, HiSilicon
R1-1611223	Performance evaluation of UL URLLC schemes	Huawei, HiSilicon
R1-1611294	Considerations on design aspects for NR URLLC	ZTE, ZTE Microelectronics
R1-1611296	Discussion on grant-free transmission for URLLC	ZTE, ZTE Microelectronics
R1-1611398	UL grant-free transmission for URLLC	CATT
R1-1611464	Discussions on grant-free for UL URLLC	Fujitsu
R1-1611465	DL control channel related to multiplexing eMBB and URLLC	Fujitsu
R1-1611466	Scheduling and CQI feedback for URLLC	Fujitsu
R1-1611545	Dynamic Resource Sharing for eMBB/URLLC in DL	Sony
R1-1611657	UL URLLC multiplexing considerations	Huawei, HiSilicon
R1-1611658	HARQ design for UL URLLC	Huawei, HiSilicon
R1-1611659	HARQ design for DL URLLC	Huawei, HiSilicon
R1-1611689	Grant-free transmission scheme for UL URLLC	Huawei, HiSilicon
R1-1611700	eMBB data transmission to support dynamic resource sharing between eMBB and URLLC	Guangdong OPPO Mobile Telecom.
R1-1611849	On multiplexing between eMBB and URLLC	LG Electronics
R1-1611850	Discussion on control and data transmission of URLLC	LG Electronics

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R1-1611895 eMBB and URLLC Multiplexing for DL FUJITSU Laboratories of Europe
R1-1612004 Uplink URLLC transmission schemes Intel Corporation
R1-1612097 On data transmisssion to support multiplexing of eMBB and URLLC Lenovo
R1-1612149 URLLC and eMBB DL Multiplexing using CRC MediaTek Inc.
R1-1612222 Dynamic resource sharing between eMBB and URLLC in DL ETRI
R1-1612246 Discussion on HARQ support for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612247 Punctured Scheduling for Low Latency Transmissions Nokia, Alcatel-Lucent Shanghai Bell
R1-1612248 Pause-Resume Scheduling for Low Latency Uplink Transmissions Nokia, Alcatel-Lucent Shanghai Bell
R1-1612249 Early Hybrid ARQ Feedback for the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-1612250 Basic grant-free transmission procedure for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612251 Enhanced semi-persistent scheduling for 5G URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612252 Grant-free HARQ for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612253 Grant-free to grant-based switching for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612316 Scheduling and support for service multiplexing INTERDIGITAL COMMUNICATIONS
R1-1612535 Partial Retransmission for eMBB Samsung
R1-1612536 Evaluation Results of eMBB with HARQ Retransmission for Multiplexing eMBB and URLLC Samsung
R1-1612537 Evaluation results of Superposition for Multiplexing eMBB and URLLC Samsung
R1-1612538 Impact on eMBB BLER from Multiplexing eMBB and URLLC Samsung
R1-1612539 Performance of eMBB Receiver with Blind Detection of URLLC Samsung
R1-1612540 eMBB and URLLC Multiplexing in DL Samsung
R1-1612541 User Plane Latency Evaluation for URLLC in FDD Samsung
R1-1612542 User Plane Latency Evaluation for URLLC in TDD Samsung
R1-1612543 User Plane Latency for URLLC Samsung
R1-1612544 URLLC Control Channel Samsung
R1-1612545 UL URLLC Transmissions Samsung
R1-1612546 Carrier Sensing for UL URLLC Transmissions Samsung
R1-1612582 Uplink URLLC and eMBB multiplexing options Intel Corporation
R1-1612583 URLLC HARQ design considerations Intel Corporation
R1-1612584 URLLC link adaptation aspects Intel Corporation
R1-1612647 Side Information Assisted High Reliable Transmission for URLLC InterDigital Communications
R1-1612648 On transmit diversity schemes for URLLC InterDigital Communications
R1-1612713 On URLLC scheduling and HARQ mechanism NTT DOCOMO, INC.
R1-1612922 On URLLC characteristics Ericsson
R1-1612923 On URLLC design principles Ericsson
R1-1612924 On aspects of multiplexing high-reliability communication and eMBB Ericsson
R1-1612925 On high-level considerations on URLLC design Ericsson
R1-1613015 Discussion on URLLC Design Aspects Convida Wireless LLC
R1-1613433 WF on DL dynamic resource sharing between eMBB and URLLC Huawei
R1-1613635 WF on DL control channel for URLLC Huawei
R1-1613639 WF on NR-PDCCH design for URLLC InterDigital Communications
R1-1613726 WF on UL URLLC transmission without grant ZTE, ZTE Microelectronics, Nokia, Convida, Interdigital

7.1.4.5 Others

R1-1611203 Power control for CA and DC Huawei, HiSilicon
R1-1612201 Enhanced redundancy matching and process for HARQ transmission ITRI
R1-1612357 Impacts of multiple numerologies on MAC INTERDIGITAL COMMUNICATIONS
R1-1612758 Enhanced HARQ feedback in NR HTC Corporation

7.1.5 Channel coding and modulation

R1-1613710 Chairman's notes of AI 7.1.5 on channel coding and modulation for NR Ad-Hoc chair (Nokia)
The document was presented by … from …
Discussion:
Decision: The document is endorsed and content incorporated below.

7.1.5.1 Channel coding

Finalize the eMBB data channel coding scheme by selecting a channel coding scheme for information block size of eMBB data <= X, and discuss channel coding scheme for the control channel

eMBB small blocks
R1-1611107 Performance Comparison of eMBB's Channel Coding Candidates for Short Block Lengths ZTE, ZTE Microelectronics
R1-1611256 Performance evaluation of channel codes for small block sizes Huawei, HiSilicon

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R1-1613165 Performance Comparison of Channel Coding Candidates for Short Block Sizes Ericsson
Revision of R1-1611316
R1-1613343 Comparison of coding candidates for eMBB data channel of short codeblock length MediaTek Inc.
Revision of R1-1612134
R1-1612276 Coding performance for short block eMBB data Nokia, Alcatel-Lucent Shanghai Bell
R1-1613123 Link Level Evaluation of FEC for Data Channel in NR AT&T GNS Belgium SPRL
Revision of R1-1612372
R1-1612555 HARQ Performance Comparison of LDPC and Polar Samsung
R1-1612585 Discussion on EMBB data channel coding for block lengths less than X Intel Corporation

R1-1611401 Evaluation of channel coding schemes with short block size for eMMB CATT
R1-1611478 Comparation of Polar and LDPC with short information length for eMBB scenario Spreadtrum Communications
R1-1611690 System evaluation of coding schemes Huawei, HiSilicon
R1-1611703 Evaluation results of channel coding for NR Guangdong OPPO Mobile Telecom.
R1-1611851 Channel coding scheme selection for eMBB LG Electronics
R1-1612136 Simulation result update for NR channel coding MediaTek Inc.
R1-1612547 Discussion on Channel Coding for eMBB Data Channel Samsung
R1-1612549 Performance of Short-Length Channel Codes for NR Samsung
R1-1612653 On Channel Codes for eMBB Data Channel with Small Block Sizes InterDigital Communications
R1-1612654 Updated Turbo Codes Simulation Data Sharing for eMBB Data Channel InterDigital Communications
R1-1612712 Performance evaluation of channel codes for eMBB small block sizes NTT DOCOMO, INC.
R1-1612782 Simulation results for eMBB small data CATR
R1-1612652 Summary of channel coding simulation data sharing for eMBB data channel InterDigital Communications

R1-1612085 Implementation for short blocks in EMBB Qualcomm Incorporated
R1-1612306 On the hardware implementation of channel decoders for short block lengths AccelerComm Ltd

R1-1611253 Summary of code combination for eMBB data channel Huawei, HiSilicon
R1-1611319 Channel coding for eMBB data Ericsson
R1-1611863 Discussion on eMBB data channel coding scheme KT Corp.
R1-1613264 Selection criteria for short block eMBB data Nokia, Alcatel-Lucent Shanghai Bell
Revision of R1-1612275
R1-1612784 Some discussions for eMBB small data schemes CATR

R1-1613363 Views on the standardisation of channel coding for NR CMCC, China Telecom, China Unicom, Bell Mobility, Deutsch Telekom, Telus
R1-1613095 WF on packet size distribution for eMBB data Ericsson, Nokia, ASB, Qualcomm, Samsung, Intel
R1-1613308 Observations on network traffic data statistics Huawei, HiSilicon

R1-1613265 WF on performance observations Nokia, Alcatel-Lucent Shanghai Bell
R1-1613341 Observations on channel coding for eMBB data Samsung, Qualcomm Corporation, Nokia, ASB, Intel Corporation

R1-1613306 WF on hardware efficiency for 2-code eMBB data channel Huawei, HiSilicon, AccelerComm, Alibaba, CATR, CATT, Coolpad, CMCC, China Telecom, China Unicom, Hytera, IMT, LG Electronics, Lenovo, MediaTek, Motorola Mobility, Neul, Nubia Technology, OPPO, Orange, Potevio, Spreadtrum, SRTC, Starpoint, TD-Tech, Turk Telekom, Vivo, Xiaomi, Xinwei, ZTE, ZTE Microelectronics, Coherent Logix, Skyworks
Also supported by InterDigital, Etisalat
Proposal:
- 2-code solution is supported for eMBB Data Channel

R1-1613097 WF on channel coding chain for eMBB data Ericsson, Qualcomm, Samsung, Intel

R1-1613347 WF on channel codes for NR short block length eMBB data AccelerComm, Ericsson, Orange, IMT, LG Electronics, NEC
Proposal:
- Turbo code is adopted for information block size of eMBB data <= 1024
- Note: if some system design constraints are found during the work item, it may be desirable to revisit the value of 1024

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R1-1613307 WF on channel coding Huawei, HiSilicon, Acer, ADI, Aeroflex, Alibaba, Bell Mobility, Broadcom, CATR, CATT, Coolpad, Coherent Logix, CHTTL, CMCC, China Telecom, China Unicom, Dish Network, ETISALAT, Fiberhome, Hytera, IAESI, III, Infineon, InterDigital, ITRI, Irdeto, Lenovo, Marvell, MediaTek, Motorola Mobility, National Taiwan University, Netas, Neul, Nubia Technology, OOREDOO, OPPO, Potevio, SGS Wireless, Skyworks, Sporton, Spreadtrum, SRTC, Starpoint, STMicroelectronics, TD-Tech, Telekom Research & Development Sdn. Bhd, Telus, Toshiba, Turk Telekom, Union Telephone, Vivo, Xiaomi, Xilinx, Xinwei, ZTE, ZTE Microelectronics
Bureau Veritas withdrew their support.
Proposal:
- Polar is supported as the channel coding scheme for DL and UL eMBB data with information block up to 1024 bits

Objections: Ericsson, Qualcomm, Nokia, ASB, Samsung, LG, ETRI, KT, VzW, Intel, Docomo, IMT, KDDI, NEC

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Proposal:
- Polar is supported as the channel coding scheme for DL and UL eMBB data with information block up to 255 bits

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R1-1613342 WF on channel coding for eMBB data Samsung, Acorn Technologies, Alcatel-Lucent Shanghai Bell, Ceragon Networks, Cohere Technologies, Ericsson, ETRI, European Space Agency, HCL Technologies limited, IAESI, Intel Corporation, ITL, KDDI, KT Corporation, Mitsubishi Electric, Motorola Solutions, NextNav, NEC, Nokia, Nomor Research, NTT Docomo, Prisma telecom testing, Qualcomm Incorporated, Reliance Jio, Sharp, SK Telecom, Sony, Straight Path Communications, T-Mobile USA, Verizon Wireless, WILUS Inc
Proposal:
- Adopt LDPC code as the single code for eMBB data channels

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Proposal:
- Adopt LDPC code as the single code for eMBB data channels at least for blocks >=256 bits

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Proposal:
- Adopt LDPC code as the single code for eMBB data channels
- It is not precluded to adopt Polar code as an additional code for small eMBB data blocks if the concerns on IR HARQ are resolved

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Proposal:
- Adopt LDPC code as the single code for eMBB data channels
- Adopt Polar code for a physical layer control channels

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R1-1611114 Selection of eMBB Coding Scheme for Short Block length ZTE, ZTE Microelectronics
R1-1611710 DL and UL Packet Sizes Supported by Channel Coding Candidates Ericsson Inc.

R1-1611317 Investigation of Code Performance with CRC Ericsson
R1-1612279 CRC attachment for eMBB data Nokia, Alcatel-Lucent Shanghai Bell
R1-1613006 A Dynamically Configurable Multi-mode NR Decoder Implementation Coherent Logix

LDPC

R1-1611321 Design of LDPC Codes for NR Ericsson
R1-1611322 Rate Matching for LDPC Codes Ericsson
R1-1611111 Consideration on the flexibility of LDPC codes for NR ZTE, ZTE Microelectronics
R1-1611112 Consideration on LDPC design for NR ZTE, ZTE Microelectronics
R1-1611260 Observations on LDPC decoders Huawei, HiSilicon
R1-1611855 Considerations on channel coding chain for eMBB LG Electronics
R1-1613059 High performance and area efficiency LDPC design with compact proto-matrix MediaTek Inc.
Revision of R1-1612132
R1-1612133 Discussion on the bit-reordering of an LDPC code block MediaTek Inc.
R1-1612280 LDPC design for eMBB data Nokia, Alcatel-Lucent Shanghai Bell
R1-1612586 LDPC design for NR data channel Intel Corporation
R1-1612937 LDPC Codes for NR KT Corp.

R1-1613269 WF on LDPC base matrix ZTE, ZTE Microelectronics, Qualcomm

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Conclusion:

- One aspect that should be considered further for the NR-LDPC design is the lifting size definition:
  - E.g. the lifting size $z = c*2^d$, where c is chosen from a set C of positive integers and, for each value of c, d is taken from the set D = [0,1, 2, 3, 4, 5, 6, 7, 8]
    - FFS the set C

R1-1613093 WF on Basics of LDPC Design Ericsson, NTU, Qualcomm, Intel, Nokia, ASB, LG, Samsung

Agreements:

- Code extension of a parity-check matrix is used for IR HARQ/rate-matching support
  - Use lower-triangular extension, which includes diagonal-extension as a special case
- For the QC-LDPC design, the non-zero sub-blocks have circulant weight <=2
  - Circulant weight is the number of superimposed circularly shifted Z×Z identity matrices
- In parity check matrix design, the highest code rate ($R_{max,j}$) to design j-th H matrix for is
  - $R_{max,j}$ <=8/9
  - $R_{max,j}$ is the code rate of the j-th H matrix before code extension is applied ($0 \leq j < J$)
  - $R_{max,j}$ is the code rate after accounting for the built-in puncturing, if this is applied in H matrix design
  - Rate matching to support transmission code rate higher than $R_{max,j}$ is not precluded

For RAN1 Jan Adhoc, companies are encouraged to work on further key characteristics / principles of the protomatrix.
For comparisons between LDPC designs, continue to use the same simulation assumptions.
Companies are encouraged to use sum-product flooding decoding algorithm with 50 iterations as a reference; other variants may also be provided.

R1-1613344 Way Forward on Objective Selection on NR LDPC Features MediaTek, ITRI, InterDigital, ZTE, NTU, CATT, Huawei, HiSilicon

R1-1611323 Improved LDPC Performance for Short Block Length Ericsson
R1-1611324 Impact of Decoding Algorithm to LDPC Code Performance Ericsson
R1-1611403 Discussion on LDPC for eMMB CATT
R1-1612081 Short block length LDPC codes Qualcomm Incorporated
R1-1612083 Adjusted min-sum decoders for LDPC codesQualcomm Incorporated
R1-1612084 Decoder sensitivity Qualcomm Incorporated
R1-1612277 Near optimal performance for LDPC with OSD/List decoding Nokia, Alcatel-Lucent Shanghai Bell
R1-1612281 IR HARQ schemes for LDPC Nokia, Alcatel-Lucent Shanghai Bell
R1-1612282 Code segmentation for eMBB data Nokia, Alcatel-Lucent Shanghai Bell
R1-1612550 Short-length LDPC Codes for NR Samsung
R1-1612551 Quasi-ML Decoding of Short Length LDPC Codes Samsung

Polar

R1-1611254 Details of the Polar code design Huawei, HiSilicon
R1-1613300 Design Aspects of Polar and LDPC codes for NR Huawei, HiSilicon
Revision of R1-1611259
R1-1611113 Consideration on Polar Codes for NR ZTE, ZTE Microelectronics
R1-1611110 HARQ Performance of Rate-compatible Polar codes ZTE, ZTE Microelectronics
R1-1613301 HARQ scheme for Polar codes Huawei, HiSilicon
Revision of R1-1611255
R1-1611320 Investigation of HARQ Design for Polar Codes Ericsson
R1-1612087 Further evaluations of Polar HARQ Qualcomm Incorporated
R1-1612278 Discussion on the IR-HARQ support of polar codes Nokia, Alcatel-Lucent Shanghai Bell
R1-1613017 Further discussion on IR HARQ for polar codes Nokia, Alcatel-Lucent Shanghai Bell
R1-1611318 Consideration of Implementation Aspects of Polar Codes Ericsson
R1-1612552 Discussion on Polar Codes for NR Samsung
R1-1612656 Interleaver for Polar Codes InterDigital Communications
R1-1613018 Polar Decoder Implementation on Memory-In-Network DSP Coherent Logix

Turbo

R1-1611258 Evaluation of enhanced Turbo Codes for eMBB small block sizes Huawei, HiSilicon

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R1-1611325 Further Enhanced Turbo Codes for NR Ericsson
R1-1612308 BLER performance of list decoding for enhanced turbo codes AccelerComm Ltd
R1-1612938 Enhanced Turbo Codes for NR: Performance Evaluation for eMBB and URLLC IMT, ORANGE

Control channels
R1-1611257 Performance evaluation of channel codes for control channel Huawei, HiSilicon
R1-1613300 Design Aspects of Polar and LDPC codes for NR Huawei, HiSilicon
Revision of R1-1611259
Section 4.1
R1-1612783 Simulation results for control channel CATR
R1-1611852 Control channel coding scheme evaluation LG Electronics
R1-1613061 Comparison of coding candidates for DL control channels and extended applications MediaTek Inc.
Revision of R1-1612135
R1-1613078 Evaluation on Channel Coding Candidates for eMBB Control Channel ZTE, ZTE Microelectronics
Revision of R1-1611109
R1-1613092 Channel Coding Candidates for Control Channel Ericsson
Revision of R1-1611326
R1-1611327 Investigation of LDPC Codes for Control Channel of NR Ericsson
R1-1612088 Control channel performance Qualcomm Incorporated
R1-1612587 Discussion on Control channel coding for NR Intel Corporation
R1-1613584 Performance of coding candidates for control channels Nokia, Alcatel-Lucent Shanghai Bell
Revision of R1-1612283

R1-1613211 WF on Channel Coding Huawei, HiSilicon, Acer, ADI, Aeroflex, Alibaba, Bell Mobility, Broadcom, CATR, CATT, Coolpad, Coherent Logix, CHTTL, CMCC, China Telecom, China Unicom, Dish Network, ETISALAT, Fiberhome, Hytera, IAESI, III, Infineon, InterDigital, ITRI, Irdeto, Lenovo, Marvell, MediaTek, Motorola Mobility, National Taiwan University, Netas, Neul, Nubia Technology, OOREDOO, OPPO, Potevio, SGS Wireless, Skyworks, Sporton, Spreadtrum, SRTC, Starpoint, STMicroelectronics, TD-Tech, Telekom Research & Development Sdn Bhd, Telus, Toshiba, Turk Telekom, Union Telephone, Vivo, Xiaomi, Xinwei, ZTE, ZTE Microelectronics
Bureau Veritas and CGC withdrew their support.
Proposal:
- Polar is supported as the channel coding scheme for DL and UL control channels for eMBB (except FFS for very small payloads)

R1-1613577 WF on coding technique for control channel for eMBB LG, AT&T, Ericsson, NEC, Qualcomm
Proposal:
- For DCI, tail-biting convolutional code (TBCC) is adopted as a channel coding technique for NR
- For UCI with encoder input size [16]<=K<=100 bits, TBCC is adopted as a channel coding technique for NR
- FFS: enhancements to LTE TBCC including generator polynomials with larger constraint length, lower native code rate

R1-1613249 WF on channel coding Etisalat, Telus, Bell Mobility, China Unicom
Proposal:
- LDPC is supported as the channel coding scheme for DL eMBB data with information block up to 1024 bits
- Polar is supported as the channel coding scheme for UL eMBB data with information block up to 1024 bits
- Polar is supported as the channel coding scheme for DL and UL control channel

R1-1613248 WF on NR channel coding Verizon Wireless, AT&T, CGC, ETRI, Fujitsu, HTC, KDDI, KT, Mitsubishi Electric, NextNav, Nokia, Alcatel-Lucent Shanghai Bell, NTT, NTT DOCOMO, Samsung, Sierra Wireless, T-Mobile USA
Proposal:
- Adopt LDPC as the single channel code for uplink and downlink eMBB data channels for all relevant info block sizes
- Adopt Polar as the channel code for the uplink control information
  - FFS for very small block lengths where repetition/block coding may be preferred
- Adopt TBCC as the channel code for the downlink control information

R1-1613250 WF on Channel Coding for NR Vodafone, CMCC, Ericsson, Deutsche Telekom, TELUS, Bell Mobility, China Unicom, China Telecom
Proposal:
- Flexible LDPC (f-LDPC) is supported as the channel coding for both DL and UL eMBB data channel for all relevant information block sizes
  - It is not precluded that other coding schemes can be added later in future release
- Polar Coding is supported as the channel coding for both Uplink and Downlink eMBB control channel (except FFS for very small payloads)

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Agreement:

- UL eMBB data channels:
  - Working Assumption to adopt flexible LDPC as the single channel coding scheme for small block sizes (to be confirmed unless significant issues are identified by the RAN1 Jan adhoc in relation to performance, implementation complexity and flexibility)
  - (Note that it is already agreed to adopt LDPC for large block sizes)
- DL eMBB data channels:
  - Adopt flexible LDPC as the single channel coding scheme for all block sizes
- UL control information for eMBB
  - Adopt Polar Coding (except FFS for very small block lengths where repetition/block coding may be preferred)
- DL control information for eMBB
  - Working Assumption to adopt Polar Coding (except FFS for very small block lengths where repetition/block coding may be preferred)
    - To be confirmed unless significant issues are identified by the RAN1 Jan adhoc in relation to performance, latency, power consumption and implementation complexity

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R1-1611402 Performance of coding candidates for NR control channel CATT
R1-1613561 Control channel complexity considerations Qualcomm Incorporated
Revision of R1-1612089
R1-1612284 Polar codes for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1612285 Reed-Muller and BCH codes for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1612286 LDPC codes for control channels Nokia, Alcatel-Lucent Shanghai Bell
R1-1612370 Link Level Evaluation of Channel Coding Schemes for Control Channel in NR AT&T GNS Belgium SPRL
R1-1612548 Discussion on Channel Coding for eMBB Control Channel Samsung
R1-1612553 Reed Muller Codes for Control Channel Samsung
R1-1612554 TBCC for eMBB Control Channel Samsung
R1-1612655 Performance Evaluation of Channel Codes for eMBB Control Channel InterDigital Communications

PBCH
R1-1611711 On Channel Coding of PBCH Ericsson Inc.

URLLC / mMTC
R1-1611108 Performance Comparison of URLLC and mMTC's Channel Coding Candidates ZTE, ZTE Microelectronics
R1-1611692 Channel coding schemes for URLLC scenario Huawei, HiSilicon
R1-1611854 Channel coding scheme evaluation for URLLC LG Electronics
R1-1612287 Evaluation criteria for URLLC/mMTC coding scheme Nokia, Alcatel-Lucent Shanghai Bell
R1-1612288 Performance of mMTC and URLLC channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell

Outer codes
R1-1611115 Consideration on outer codes for NR ZTE, ZTE Microelectronics

Miscellaneous
R1-1611853 Multiple CRC for TBCC list decoding LG Electronics
R1-1613000 On Quasi-ML and OSD decoders Huawei, HiSilicon

7.1.5.2 Modulation

Friday
R1-1613597 WF on pi/2 BPSK Modulation (Additional low PAPR Technique) IITH, CEWiT, IITM, Tejas Networks, Reliance-jio, Qualcomm, Samsung, Intel, ATT, INL, Straightpathcommunications, Huawei, Panasonic
Also supported by Sony, Kyocera, Interdigital, KDDI

Working assumption:

- NR supports 0.5*pi BPSK modulation for DFT-s-OFDM
  - While using DFT-s-OFDM, 0.5*pi-BPSK modulation using DFT-S-OFDM with frequency domain spectrum shaping can be further considered at least for eMBB uplink data for up to 40GHz
  - FFS
    - The details of frequency domain spectrum shaping

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- This does not preclude the case where no spectrum shaping is needed

R1-1611214 Signal Shaping for QAM with Flexible Rate Adaptation Huawei, HiSilicon
R1-1611252 Analysis of modulation schemes for NR Huawei, HiSilicon
R1-1611284 Performance of NU-QAM with LDPC codes for NR ETRI
R1-1611543 Performance of Non-Uniform Constellations in NR Sony
R1-1611544 Signal Space Diversity Use in NR Sony
R1-1612091 Low PAPR modulation Qualcomm Incorporated
R1-1612270 On PAPR/CM reduction techniques over QPSK/DFT-S-OFDM uplink Nokia, Alcatel-Lucent Shanghai Bell
R1-1612305 Further PAPR reduction for Uplink IITH
R1-1612556 Discussion on modulation schemes for high spectral efficiency Samsung
R1-1612557 Transmission and reception for high-order modulation in conjunction with MIMO Samsung
R1-1612558 Evaluation assumptions on high-order modulation in conjunction with MIMO for high spectral efficiency Samsung
R1-1612559 Low PAPR modulation and waveform Samsung
R1-1612657 Performance evaluation of dual carrier modulation for new radio InterDigital Communications
R1-1612658 Evaluation of spatial modulation with spatial correlation and imperfect channel estimation InterDigital Communications
R1-1612659 On fractional N-ary modulation for NR InterDigital Communications
R1-1612926 On Modulation for NR Ericsson
R1-1613002 Low PAPR modulation for DFT-s-OFDM based waveform Huawei, HiSilicon

7.1.6 Duplex and interference management

R1-1613711 Chairman's notes of AI 7.1.6 on duplexing for NR Ad-Hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm.
Discussion:
Decision: The document is endorsed and content incorporated below.

R1-1611224 General discussion on flexible duplex Huawei, HiSilicon
R1-1611404 Clarification on flexible duplex CATT
R1-1612560 Views on NR Duplexing Samsung

R1-1613291 WF on Terminology for Flexible Duplex LG Electronics, Huawei, HiSilicon
R1-1613503 WF on Terminology and Categorization for Duplexing LG Electronics, ZTE, Huawei, HiSilicon
Agreements:

- Referring to TR 38.913, the terminology of "duplexing flexibility" in NR means at least one of the following mechanisms to manage resources flexibly for uplink and downlink for both paired and unpaired spectrum.
  - 1) UL and DL usage is flexibly changed in time domain in unpaired spectrum.
  - 2) UL and DL usage is flexibly changed in time domain in UL band in paired spectrum
  - 3) UL and DL usage is flexibly changed in time domain in DL band in paired spectrum
- Note: the definition of the above terminology is not intended to have impact on prioritizing discussion on any of the above mechanisms

R1-1613219 Way Forward on operation of flexible duplex Huawei, HiSilicon, LGE
R1-1613462 Operation on paired spectrum Huawei, HiSilicon

R1-1613139 WF on Dynamic TDD AT&T, Ericsson, Intel, Samsung
Agreements:

- NR should support dynamically assigned DL and UL transmission directions at least for data on a per-slot basis at least in a TDM manner
  - FFS control signaling details (e.g. UE or cell-specific, applicable for cross and/or same-slot scheduling, switching between dynamic and semi-static operation, etc.)
  - FFS adaptation at the level of a mini-slot
  - Other aspects, if any, are not excluded
- Note: the applicability of the above bullets in terms of spectra is a separate discussion

R1-1613220 Way Forward on TP structure for flexible duplex in TR 38.802 Huawei, HiSilicon, Intel
R1-1613463 Way Forward on TR structure for flexible duplex Huawei, HiSilicon, Fujitsu, ZTE

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Conclusion:

- Rapporteur to come up with a skeleton for duplexing flexibility, e.g., using the following as a start point:
  - X. Duplexing flexibility
    - X.1 Duplexing mechanisms
    - X.2 Cross-link interference mitigation
    - X.3 Evaluation of duplexing flexibility
    - X.4 Summary and conclusions

R1-1611229 On SRS transmission in flexible duplex Huawei, HiSilicon

7.1.6.1 Performance evaluation

Including performance evaluation with duplexing and potential interference mitigation schemes to manage cross-link interference

R1-1611679 Evaluation method of flexible duplex Huawei, HiSilicon
R1-1612125 Remaining issues in evaluation methodology for dynamic TDD MediaTek Inc.
R1-1612155 Discussion on performance evaluation of interference management in NR ZTE, ZTE Microelectronics
R1-1613522 Discussion on performance evaluation of interference management in NR ZTE, ZTE Microelectronics

Agreements:

- Update the following simulation parameters about the deployment scenario of "Dense urban":

Parameters	Dense urban
Layout	Two layer: – Macro layer: Hex. Grid – Micro layer: Random drop (All micro BSs are outdoor) – 3 micro BSs per macro BS – 6 micro BSs per macro BS (optional) – 9 micro BSs per macro BS (optional)

Agreements:

- Companies to report the delay assumption used for coordination schemes if used in the simulations
  - Note that the delay assumption depends on RAN3 architecture discussions

R1-1612736 Performance evaluation of dynamic TDD in dense urban scenario NTT DOCOMO, INC.
R1-1612770 Performance of Dynamic TDD at 4 GHz Ericsson

R1-1611230 Evaluation of flexible duplex in indoor hotspot scenario Huawei, HiSilicon
R1-1611231 Evaluation of flexible duplex in urban macro scenario Huawei, HiSilicon
R1-1611232 Evaluation of flexible duplex in dense urban scenario Huawei, HiSilicon
R1-1611856 System level evaluation for flexible duplex in dense urban scenario LG Electronics
Late submission
R1-1612126 Evaluation of dynamic TDD in indoor hotspot scenario MediaTek Inc.
R1-1612561 Performance Evaluation of Dynamic TDD Samsung
R1-1612771 Performance of Dynamic TDD at 30 GHz Ericsson

7.1.6.2 Interference management

Including potential cross-link interference mitigation schemes

R1-1611226 Symmetric RS design for flexible duplex Huawei, HiSilicon
R1-1611857 Discussion on coordination for cross-link interference mitigation LG Electronics
R1-1612005 Subframe structure for NR dynamic TDD Intel Corporation
R1-1612094 Dynamic TDD data interference considerations Qualcomm Incorporated
R1-1612157 Sensing based scheme for dynamic TDD in NR ZTE, ZTE Microelectronics
R1-1612230 Discussion on NR duplexing Panasonic Corporation
R1-1612271 Dynamic TDD Interference Mitigation concepts in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-1612563 Dynamic TDD Cross-link Interference Avoidance based on Channel Sensing Samsung
R1-1612773 On the Design of Dynamic TDD Ericsson
R1-1613016 Discussion on interference Measurement in NR Convida Wireless LLC

R1-1613270 WF on sensing based scheme for duplex in NR ZTE
R1-1613221 Cross-link interference mitigation for flexible duplex Huawei, HiSilicon, Intel
R1-1613464 Cross-link interference mitigation for flexible duplex Huawei, HiSilicon, CATT, Intel, ZTE
R1-1613272 WF on measurements for dynamic TDD Samsung, AT&T, ZTE

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R1-1613515 WF on measurements for dynamic TDD Samsung
R1-1613319 WF on OTA signaling for dynamic TDD in NR Mediatek, CATT

Agreements:

- At least following schemes are identified to be further studied aiming to mitigate cross-link interference with and without the assumption on inter-cell coordination:
  - Advanced receiver for interference cancellation/suppression
  - RS design (e.g. symmetric RS) and timing alignment between DL and UL
  - Sensing/measurement scheme (e.g. LBT-like, OTA measurement if any, etc.)
  - Power control and coordinated schemes (e.g. coordinated beamforming/scheduling, OTA signalling if any, etc.)
  - Link adaptation
- Strive for common cross-link interference mitigation schemes for both paired and unpaired spectrum.
- For further study of measurements of cross link interference (CLI), aim for (if possible) reusing a physical reference signal used for other purposes
  - The need to enable CLI measurement should be taken into account when designing the RS which is also to be used for CLI measurement
  - Study metric(s) to be used for CLI measurement, e.g., RSRP
  - Physical reference signal used for CLI measurement aim for the same type for DL & UL (e.g. DM-RS type, CSI-RS type, etc.)
  - To support CLI measurement, RS of a UE or a TRP aim to be received by another UE or another TRP

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R1-1611225 Benefits of cross-link interference mitigationHuawei, HiSilicon
R1-1611227 Timing alignment on cross-link for flexible duplex Huawei, HiSilicon
R1-1611228 Interference sensing for flexible duplex Huawei, HiSilicon
R1-1611405 Interference management for dynamic TDD and flexible duplex CATT
R1-1611660 Power control for flexible duplex Huawei, HiSilicon
R1-1611858 Cross-link interference management for coexistence between NR and LTE LG Electronics
R1-1611859 Discussion on dynamic and semi-static DL/UL configuration for inter-cell interference coordination/ LG Electronics
R1-1612006 Interference management for NR TDD Intel Corporation
R1-1612093 Dynamic TDD control interference considerations Qualcomm Incorporated
R1-1612124 Considerations on interference management in NR MediaTek Inc.
R1-1612156 Discussion on duplex and interference management ZTE, ZTE Microelectronics
R1-1612158 Discussion on dynamic TDD operations ZTE, ZTE Microelectronics
R1-1612159 Way Forward on Duplexc and Interference Management ZTE, ZTE Microelectronics
R1-1612272 UL Interference Coordination and Power Control Nokia, Alcatel-Lucent Shanghai Bell
R1-1612273 On the cross-link interference mitigation Nokia, Alcatel-Lucent Shanghai Bell
R1-1612562 Dynamic TDD Cross-link Interference Detection and Reporting Samsung
R1-1612564 RS Design for Cross-link Interference in Dynamic TDD Samsung
R1-1612565 Signaling of Slot Structure Samsung
R1-1612566 Dynamic TDD for Latency Reduction in DL Samsung
R1-1612567 Cross-link interference management for vertical services Samsung
R1-1612737 Mechanisms for flexible duplex NTT DOCOMO, INC.
R1-1612772 On Cross-Link Interference Mitigation for Dynamic TDD Ericsson

7.1.6.3 Other

R1-1612117 On user and traffic distribution for extreme rural scenario Facebook
R1-1612756 In-band full duplexing in NR HTC Corporation

7.1.7 Other

Including remaining evaluation assumptions, coexistence between NR and LTE, remaining issues on waveform and multiple access
Also including forward compatibility not covered by above agenda items

R1-1611251 Summary of simulation results for NR MA Huawei, HiSilicon
R1-1611680 Discussion on 5G channel model Huawei, HiSilicon
R1-1612899 Channel model for evaluation of Rural scenario Ericsson
R1-1613312 Way Forward on channel model for rural scenario in NR Huawei, HiSilicon, CATT, CATR
R1-1613116 Channel model for evaluation of Rural scenarioEricsson, T-Mobile USA, Telstra, Samsung, AT&T, Sprint, Xilinx, Intel, NTT DOCOMO
Also supported by Verizon, Nokia, ASB

Working assumption:

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- Use 38.900 RMa as a starting point for NR evaluations in the rural deployment scenario for frequencies below 6 GHz, with the following modifications:
  - FFS on possible modifications to O2I and elevation parameters in 38.900 RMa
    - Based on new measurements of O2I and 3D parameters in rural scenario
    - Companies are encouraged to bring new measurement results, if any

R1-1612192 **Discussion on the azimuth direction of the main beam for high speed scenario evaluation CMCC**

Agreements:
- The optimized azimuth beam direction should be determined by observing both DL geometry and UL geometry.
- One option for antenna downtilt for high speed scenario is to reuse the downtilt for rural scenario, i.e., 6 degrees.
- One value for the optimized azimuth beam direction is 27 degrees to the railway track. This is obtained assuming that the half power beam points to the midpoint between the two adjacent sites along the railway.

R1-1612170 **Requirements on Future Railway Mobile Communication ZTE**

Coexistence

R1-1611681 **Coexistence between NR and LTE Huawei, HiSilicon**

Proposal 1: RAN1 to focus on coexistence in the same licensed frequency band:
- *Co-located LTE/NR with synchronization for unpaired or paired spectrum deployment*
- *Non-co-located LTE/NR, with or without synchronization for unpaired or paired spectrum deployment, with or without fast backhaul connections.*

Proposal 2: NR/LTE coexistence should consider TDM, FDM, and using a LTE carrier or a NR carrier as NR user's anchor carrier.

Proposal 3: Coexistence requirements for NR mainly include:
- *For co-located LTE/NR, resource sharing and indication via forward compatible designs*
- *For non-co-located LTE/NR, interference management at least by reusing LTE interference management schemes.*

Proposal 4: Coexistence requirements for LTE mainly include:
- *For co-located LTE/NR, introducing higher degree of adaptation/flexibility in time/frequency domains*
- *For non-co-located LTE/NR, considering further enhanced interference management schemes.*

Proposal 5: Coexistence should be supported by LTE/NR at subframe-level in time domain and at PRB-level in frequency domain if the same numerology and slot size is used.

Proposal 6: NR should provide sufficiently flexible design forward compatible with NR and LTE further evolution (e.g., new LTE features such as short TTI).

Decision: The document is noted.

R1-1612887 **Uplink operation for LTE+NR Dual Connectivity VODAFONE Group Plc**

The document highlights that there are some deployment complexities and drawbacks in requiring 2 uplink carriers to always be operated with LTE+NR aggregation (DC), and allowing a single uplink carrier to transport both LTE uplink and NR L1/2 control feedback would simplify operation when deploying NR in a new band, and make it no less complicated than deploying LTE radio in that band.
Asks RAN1 to study this further, as part of the LTE-NR coexistence work, and consider specifying this capability within Rel-15.
Discussion: Intel→ contribution seems more appropriate for discussion within RAN2 rather than in RAN1.
Decision: The document is noted.

R1-1613034 **LTE-NR Coexistence Samsung**

- *Proposal 1: Design TDD UL-DL configurations for NR such that at least a subset of the configurations are compatible with those of LTE.*
- *Proposal 2: Support indication of the starting symbol for NR transmission.*

Decision: The document is noted.

R1-1613263 **WF on LTE-NR Coexistence Huawei, HiSilicon, AT&T, Orange**

The document was presented by David Mazzarese from Huawei.
Discussion: Chair→ focus on proposal 1 first "NR mechanisms that enable coexistence with LTE"
Samsung→ are we going to agree all the proposed mechanisms? – too detailed at this stage, let's discuss principles first
Nokia: spectrum sharing needs to be addressed anyway
NTT DOCOMO→ shouldn't we define first the key features affecting coexixtence
Decision: The document is noted.

Agreements:

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- For LTE and NR coexistence,
  - In NR design, consider support of flexible starting point and duration of scheduled resources as a tool to avoid for example the control region of MBSFN subframes and be able to use resources in the unused MBSFN subframes of an LTE carrier
    - Note: those mechanisms may be reused from forward compatibility mechanisms
    - FFS: use of mini-slot
    - FFS: Dynamically or semi-statically varying starting point and duration
  - NR design supports adapting the bandwidth occupied by NR carrier(s) at least as fast as LTE carrier aggregation schemes
    - FFS: Detailed design
  - FFS: Allowing NR transmissions while avoiding OFDM symbols carrying CRS on a DL LTE subframe
    - Further discussion needed on how to handle sTTI transmissions of LTE
    - Note: those mechanisms may be reused from forward compatibility mechanisms, or mechanisms for multiplexing eMBB and URLLC on the DL, or mini-slot
  - Allowing NR transmissions while avoiding OFDM symbols carrying SRS on an UL LTE subframe
    - Further discussion needed on how to handle sTTI transmissions of LTE
  - FFS: PRB-level resource allocation can be used as a tool to avoid for example PSS/SSS, PBCH, EPDCCH, PUCCH, PRACH, as well as PRB-level scheduled LTE PDSCH and LTE PUSCH, of an LTE carrier
  - FFS: Mapping NR signals and channels around the LTE CRS patterns
  - Note: those mechanisms may be reused from forward compatibility mechanisms

Possible agreements:

- NR should support a mechanism to avoid collision between DL and UL transmissions between NR and LTE
  - Design at least one semi-statically assigned DL/UL transmission direction for NR that avoids DL/UL interference with at least one LTE DL/UL subframe configuration

Wednesday session

Agreements:

- For adjacent channel/band operation of NR and LTE in the unpaired spectrum
  - Design at least one semi-statically assigned DL/UL transmission direction configuration for NR that avoids DL/UL interference with at least one LTE TDD DL/UL configuration and special subframe configuration
  - This does not preclude at most one semi-statically DL/UL transmission direction configuration in NR specification
  - Note: DL/UL interference also can be avoided by using dynamically assigned DL/UL transmission direction in some cases
  - FFS: Backhaul signaling between NR and LTE for interference coordination
  - FFS: Other mechanisms

- Note that the above agreements do not imply that UE has to support simultaneous connection of NR and LTE in the same or overlapping carrier
- Note: that above mechanisms may be reused from forward compatibility mechanisms, or mechanisms for multiplexing eMBB and URLLC on the DL, or mini-slot

R1-1612927 **On scrambling Ericsson**

- Scrambling of unicast data should not depend on the transmission time or the identity of a transmission point.

Decision: The document is noted.

R1-1611248 **Forward compatibility considerations on NR operations of the unlicensed band Huawei, HiSilicon**

Proposal 1: NR should study the operations on the unlicensed bands including sub-1GHz, 2.4GHz, 5GHz and 60GHz.
Proposal 2: At least the following requirements from regulation should be considered when studying forward compatibility for unlicensed band operations

- *Channel bandwidth and occupied channel bandwidth (OCB)*
- *maximum channel occupancy time (MCOT)*
- *Listen before talk (LBT)*

Proposal 3: Flexible channel bandwidth considering coexistence should be supported for different unlicensed bands.
Proposal 4: NR should strive to minimize reservation signal in unlicensed band transmission in the frame structure and reference signal design.
Proposal 5: NR should support flexible timing relationship to ensure the following transmission and reception finishing within same MCOT.

- *DL data reception and corresponding acknowledgement*
- *UL assignment and corresponding UL data transmission.*

Decision: The document is noted.

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R1-1612794 **Forward Compatibility of NRAT with satellite systems** **THALES**

Satellite industry is striving for adopting 3GPP defined Radio Access Technology in future satellite systems. In order to prepare the study of such satellite radio access network as part of phase 2, it is proposed to define system level simulation parameters.

Discussion: Chair→ satellite systems have already been discussed in RAN plenary
Thales→ how are the proposed parameters going to be treated?
Chair→ let's discuss further and wait for next plenary's decision → could be addressed in 2017Q1
Decision: The document is noted.

The document was presented by … from …
Discussion:
Decision: The document is noted.

R1-1611467 Further LLS results for UL non-orthogonal multiple access Fujitsu
R1-1611499 Remaining issues on system level simulation for multiple access ZTE, ZTE Microelectronics
R1-1611500 Further consideration on the preamble design for grant-free non-orthogonal MA ZTE, ZTE Microelectronics
R1-1611501 Discussion on HARQ for grant free based transmission ZTE, ZTE Microelectronics
R1-1611549 Discussion on NR uplink interleave-domain NOMA Sony
R1-1611682 Network synchronization for NR Huawei, HiSilicon
R1-1611683 Discussion on forward compatibility between non-standalone and standalone NR operation Huawei, HiSilicon
R1-1611860 Forward compatibility issues considering NR operation in unlicensed spectrum LG Electronics
R1-1611861 On coexistence of NR and LTE LG Electronics
R1-1612007 Considerations on eV2X NR designIntel Corporation
R1-1612008 Preliminary eV2X Evaluation Analysis Intel Corporation
R1-1612009 Efficient coexistence of NR with LTE Intel Corporation
R1-1612160 Discussion on NR operation in unlicensed spectrum ZTE, ZTE Microelectronics
R1-1612167 Further considerations on NR waveform with improved spectral containment Intel Corporation
R1-1612168 On unified NR frame structure for different spectrum types ZTE, ZTE Microelectronics
R1-1612169 Operation on high frequency of unlicensed spectrum in NR ZTE, ZTE Microelectronics
R1-1612202 Enhancement to sidelink physical layer structure in high speed scenarios for new radio ITRI
R1-1612304 Satellite Aspects- Forward Compatibility Consideration for NR Channel Coding Dish Network
R1-1612373 LTE and NR coexistence AT&T GNS Belgium SPRL
R1-1612378 UW DFTsOFDM performance evaluation above 40GHz Mitsubishi Electric
R1-1612569 DFT-based IGMA Samsung
R1-1612570 PAPR evaluation results for DFT-based IGMA Samsung
R1-1612571 Grant-free Based Multiple Access Samsung
R1-1612572 Basic Channel Structure for Grant-Free Based Multiple Access Samsung
R1-1612573 Collision Analysis of Grant-Free Based Multiple Access Samsung
R1-1612574 Link level simulation results for IGMA Samsung
R1-1612575 Considerations on evaluation method for IGMA Samsung
R1-1612576 SLS evaluation results for IGMA Samsung
R1-1612588 Single carrier based waveform for high frequency bands above 40 GHz Intel Corporation
R1-1612589 Further discussion on GI-DFT-s-OFDM for high frequency bands above 40 GHzIntel Corporation
R1-1612590 Views on multiple NR waveform proposals for high bands Intel Corporation
R1-1612608 Initial view on sidelink communication in NR KDDI Corporation
R1-1612684 System Level Evaluation of Low Code-Rate Multiple Access Schemes InterDigital Communications
R1-1612685 On the Operation of Grant-Free Access InterDigital Communications
R1-1612775 On Coexistence Between LTE and NR Ericsson
R1-1612776 On NR Operation in the 60 GHz Unlicensed Band Ericsson
R1-1612777 On Channel Access Mechanisms for NR in Unlicensed Spectrum Ericsson
R1-1612778 Technology Components for Unlicensed Operation Ericsson
R1-1612779 On Autonomous UL Transmissions for NR in Unlicensed Spectrum Ericsson
R1-1612780 Discussion of Multi-Antenna and Highly Directional Beam-Forming for Operation in Unlicensed Spectrum Ericsson
R1-1612781 On Physical Layer Design Policies for Unlicensed Operation of NR Ericsson
R1-1612785 Discussion on non-orthogonal multiple access for URLLC usage scenario CATR
R1-1612793 Non-orthogonal coded access Nokia, Alcatel-Lucent Shanghai Bell
R1-1612834 Forward Compatibility of NRAT with HAPS systemsTHALES
R1-1612877 Evaluation of UW DFT-s-OFDM as a zero-length CP waveform for high speed train scenario Mitsubishi Electric Co.
R1-1612929 Antenna pattern at UE/RSU in NR eV2X Ericsson

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R1-1612940	Discussions on simulation scenarios of NR eV2X at 63GHz	Ericsson
R1-1612942	On NB-IoT, eMTC and NR coexistence	Ericsson LM
R1-1612943	On mMTC multiple access	Ericsson LM
R1-1612948	Discussions on traffic model for NR eV2X	Ericsson
R1-1612949	On battery models for mMTC	Ericsson LM
R1-1612950	On the evolution of mMTC	Ericsson LM
R1-1612954	On Channel Estimation for Shared Grant-Free Access	Ericsson
R1-1612955	Framework For Grant-free Access	Ericsson
R1-1612956	On Reference Signal Design for Grant-free Access	Ericsson
R1-1612957	Synchronization aspects for grant-free access	Ericsson
R1-1612958	Resource Configuration for Grant-free Access	Ericsson
R1-1612972	Update to channel models for eV2X evaluation	Ericsson

7.2 Other

Including channel model for frequency spectrum above 6 GHz

R1-1613712 Chairman's notes of AI 7.2 Ad-Hoc chair (Nokia)
The document was presented by Matthew Baker from Nokia.
Decision: The document is endorsed and content incorporated below.

TR38.900
R1-1613190 TR38.900_CR_Harmonizing_Terminology Fraunhofer
Decision: CR0054r1 to 38.900 (Rel-14, F) is agreed.

Section 7.1.3
R1-1613021 Draft CR for TR38.900 Section 7.1.3 ETRI
Decision: Agreed as CR0065 to 38.900 (Rel-14, F) in R1-1613244.

Section 7.3
R1-1613189 TR38.900_CR_Azimuthal_Angle_Notation Fraunhofer
Decision: CR0053r1 to 38.900 (Rel-14, F) is agreed.

Section 7.4.1
R1-1613074 TR38.900_CR_Correction_of_UMa_BP_definition Fraunhofer HHI (Revision of R1-1612962)
Decision: CR0061r1 to 38.900 (Rel-14, F) is agreed.

Section 7.5
R1-1613077 Ground Reflection Model Fraunhofer HHI
Proposes a new component to the model.
Late submission – check until RAN1#88

Section 7.6.3
R1-1612897 Correction for spatial consistency procedure Ericsson
Decision: CR0058 to 38.900 (Rel-14, F) is agreed.
R1-1613064 Correction for spatially-consistent UT mobility handling Ericsson (Revision of R1-1612896)
Further revised in R1-1613525
R1-1613525 Correction for spatially-consistent UT mobility modelling Ericsson, Fraunhofer HHI, Nokia, Alcatel-Lucent Shanghai Bell
Decision: CR0057r2 to 38.900 (Rel-14, F) is agreed.
Note – there may be some remaining issues with this CR – a revised version (revision 3) is submitted in R1-1613497, which companies are encouraged to check until RAN1#88. It is proposed to un-agree R1-1613525.
Friday: Confirmation that R1-1613525 is not agreed and the CR is postponed to next meeting.

R1-1612735 Detailed modeling methodology of spatial consistency NTT DOCOMO, INC.
Decision: Continue discussion at RAN1#88; possibly consider a CR to the calibration section of the TR.

Section 7.6.5
R1-1613063 Correction for correlation modeling for multi-frequency simulations Ericsson (Revision of R1-1612895)
Decision: Discuss offline until RAN1#88.

Section 7.7.1

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R1-1613353 **Correction for channel models for link-level evaluations** **Ericsson** (Revision of R1-1612894)
Decision: CR0055r1 to 38.900 (Rel-14, F) is agreed.

Section 7.7.2
R1-1613073 **TR38.900_CR_TDL_and_KF_scaling** **Fraunhofer HHI** (Revision of R1-1612953)
Decision: CR0060r1 to 38.900 (Rel-14, F) is agreed.

Section 7.7.5
R1-1613065 **Correction for scaling of angles for CDL models** **Ericsson** (Revision of R1-1612987)
Decision: CR0062r1 to 38.900 (Rel-14, F) is agreed.

Section 7.8.2
R1-1612898 **Correction for terminology of UE antenna model and scattering** **Ericsson**
Decision: CR0059 to 38.900 (Rel-14, F) is agreed.

R1-1613066 **Correction for scenario description** **Ericsson**
Late submission
Decision: Check until RAN1#88.

Not treated.
R1-1613637 Additional feature calibration results Xinwei
R1-1613638 Update of additional feature calibration results Xinwei

TR36.873
R1-1613315 **Draft CR for TR36.873 Section 5.1.3** **ETRI** (Revision of R1-1613022)
Decision: The CR is agreed as CR0011 to 36.873 (Rel-12, F) in R1-1613245.

R1-1612967 **TR36.873_CR_Section_7.1** **Fraunhofer HHI**
R1-1613195 **TR36.873_CR_Section_7.2** **Fraunhofer HHI**
R1-1612982 **TR36.873_CR_Section_7.3** **Fraunhofer HHI**
R1-1613192 **TR36.873_CR_LOS_Probability** **Fraunhofer HHI**
Nokia – not correct.
No consensus to agree the above 4 CRs.
If consensus emerges on some useful changes, this can be revisited in a future meeting.

R1-1613191 **TR36.873_CR_Section_7.3** **Fraunhofer HHI**
Decision: CR0006r1 to 36.873 (Rel-12, F) is agreed.

TR25.996
R1-1613076 **Correction of Circular Angle Spread** **Fraunhofer HHI**
Late submission
Decision: Check until RAN1#88.

TR36.814
R1-1613193 **TR36.814_CR_Section_B.1.2.2.1** **Fraunhofer HHI**
Decision: CR0002r1 to 36.814 (Rel-9, F) is agreed.
R1-1613194 **TR36.814_CR_LOS_Probability** **Fraunhofer HHI**
Decision: CR is not pursued.
Consider adding a note in 38.900 to state the equivalence of the formulae – revisit at RAN1#88.

8 Closing of the meeting

Mr Chair thanked all for the hard work during the week. Still two meetings to complete the SI on NR with the confirmation that January ad-hoc meeting will be hosted by NAF3 in Spokane, Washington.

Before closing the meeting, RAN1 chair raised the issue regarding the number of contributions in RAN1 following the comments made by several companies during this week.
Chair: should I limit the number of contributions per company?
Nokia (VC): risk with such a limitation is on contributions addressing too many topics in one unique Tdoc, and consequently a difficulty to address and treat them
Fujitsu: Having more informative titles may help to sort them out
Huawei: Companies should work together before the meeting and come with joint contributions
Samsung→ commented that they noticed nice combination of supporting companies in many way forward – not really fair!
Intel: Support the idea to limit the number of WF per company

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RAN1 chair: acknowledge that a number of WF are meaningless (applauses by RAN1) – noticed a sort of competition
- also noticed that WF as one specific company proposal is in fact a late contribution
Samsung: Increasing the granularity of sub-agenda may help
AT&T: better stop such online discussion as meeting closing time has ready passed – exchange ideas over email reflector could help to progress further
Qualcomm: doesn't believe that email discussion is a good idea
RAN1 chair: let's stop – will decide by himself and let RAN1 WG knows about it

Huawei (David Mazzarese) commented that NR TR was endorsed while he wasn't in the room due to too many offline discussions – some of the Huawei's comments on TR have been ignored
NTT DOCOMO (rapporteur) → Huawei delegates were present when TR has been endorsed
RAN1 chair: TR is for for information to plenary – still two meetings in front of RAN1 to complete the SI – there will be opportunity to capture/improve the content of the TR in the the future.

MCC: Purpose of the NR ad-hoc meeting hosted by NAF3 in January 2017 is clear.
RAN1 mandates this Ad hoc meeting with full decision power for NR. This Ad hoc meeting is for NR only.

Meeting was closed at 17:17.
See you all in Athens, and in Spokane for NR interested..

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Athens, Greece, 13th – 17th February 2017

Annex A: List of Tdocs at RAN1 #87

Please see excel file attached to this report

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Annex B: List of CRs agreed at RAN1 #87

TR	CR	Rev	Rel	Title	Cat	Vsn	@ Mtg	TD#	Source to WG	Work Item
36.814	2	1	Rel-9	TR36.814_CR_Section_B.1.2.2.1	F	9.0.0	R1#87	R1-1613193	Fraunhofer HHI	FS_RAN_LTEA
36.873	6	1	Rel-12	TR36.873_CR_Section_7.3	F	12.2.0	R1#87	R1-1613191	Fraunhofer HHI	FS_LTE_3D_channel
36.873	11	-	Rel-12	CR for TR36.873 Section 5.1.3	F	12.2.0	R1#87	R1-1613245	ETRI	FS_LTE_3D_channel
38.900	53	1	Rel-14	TR38.900_CR_Azimuthal_Angle_Notation	F	14.1.0	R1#87	R1-1613189	Fraunhofer HHI	FS_6GHz_CH_model
38.900	54	1	Rel-14	TR38.900_CR_Harmonizing_Terminology	F	14.1.0	R1#87	R1-1613190	Fraunhofer HHI	FS_6GHz_CH_model
38.900	55	1	Rel-14	Correction for channel models for link-level evaluations	F	14.1.0	R1#87	R1-1613353	Ericsson, Fraunhofer HHI	FS_6GHz_CH_model
38.900	58	-	Rel-14	Correction for spatial consistency procedure	F	14.1.0	R1#87	R1-1612897	Ericsson	FS_6GHz_CH_model
38.900	59	-	Rel-14	Correction for terminology of UE antenna model and scattering	F	14.1.0	R1#87	R1-1612898	Ericsson	FS_6GHz_CH_model
38.900	60	1	Rel-14	TR38.900_CR_TDL_and_KF_scaling	F	14.1.0	R1#87	R1-1613073	Fraunhofer HHI, Ericsson	FS_6GHz_CH_model
38.900	61	1	Rel-14	TR38.900_CR_Correction_of_UMa_BP_definition	F	14.1.0	R1#87	R1-1613074	Fraunhofer HHI, Ericsson	FS_6GHz_CH_model
38.900	62	1	Rel-14	Correction for scaling of angles for CDL models	F	14.1.0	R1#87	R1-1613065	Ericsson, Fraunhofer HHI	FS_6GHz_CH_model
38.900	65	-	Rel-14	CR for TR38.900 Section 7.1.3	F	14.1.0	R1#87	R1-1613244	ETRI	FS_6GHz_CH_model
TS	**CR**	**Rev**	**Rel**	**Title**	**Cat**	**Vsn**	**@ Mtg**	**TD#**	**Source to WG**	**Work Item**
36.211	309	-	Rel-14	Correction on NZP CSI-RS aggregation for Class A	A	14.0.0	R1#87	R1-1611917	Intel, LG Electronics, Samsung	LTE_EBF_FDMIMO-Core
36.213	786	-	Rel-14	Correction on the UL Type 1 channel access description	F	14.0.0	R1#87	R1-1611918	Intel Corporation	LTE_eLAA-Core
36.211	296	1	Rel-13	Correction on NZP CSI-RS aggregation for Class A	F	13.3.0	R1#87	R1-1612012	Intel, LG Electronics, Samsung	LTE_EBF_FDMIMO-Core
36.213	787	-	Rel-14	Correction on downlink power allocation for SC-PTM	A	14.0.0	R1#87	R1-1612214	TD Tech, Huawei	LTE_SC_PTM-Core
36.213	789	-	Rel-13	Corrections on the description of carrier for NB-IoT in TS 36.213	F	13.3.0	R1#87	R1-1612829	Huawei, HiSilicon	NB_IOT-Core
36.213	790	-	Rel-14	Corrections on the description of carrier for NB-IoT in TS 36.213	A	14.0.0	R1#87	R1-1612830	Huawei, HiSilicon	NB_IOT-Core
36.213	796	-	Rel-13	Control information inconsistent handling for NB-IoT in 36.213	F	13.3.0	R1#87	R1-1612996	Ericsson	NB_IOT-Core
36.213	797	-	Rel-14	Control information inconsistent handling for NB-IoT in 36.213	A	14.0.0	R1#87	R1-1612997	Ericsson	NB_IOT-Core
36.213	800	0	Rel-13	Rel-13 CR on MCOT limits for carriers on which eNB performs Type B LBT	F	13.3.0	R1#87	R1-1613101	Qualcomm Incorporated	LTE_LAA-Core

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36.212	232	-	Rel-14	Miscellaneous corrections for V2V in 36.212	F	14.0.0	R1#87	R1-1613127	Huawei	LTE_SL_V2V-Core
36.213	801		Rel-13	Correction on DL CWS adjustment for LAA	F	13.3.0	R1#87	R1-1613128	LG Electronics, Intel	LTE_LAA-Core
36.212	233	0	Rel-14	CR on correction to the PUSCH start position reference and relative timing offset in UL DCI for LAA	F	14.0.0	R1#87	R1-1613134	Qualcomm Incorporated	LTE_eLAA-Core
36.213	803	-	Rel-14	Corrections to EPDCCH candidate derivation procedure for eLAA in TS36.213	F	14.0.0	R1#87	R1-1613135	Sharp	LTE_eLAA-Core
36.211	314	1	Rel-13	Mapping of MPDCCH and PDSCH	F	13.3.0	R1#87	R1-1613137	Sequans Communications, Qualcomm Incorporated, Samsung	LTE_MTCe2_L1-Core
36.211	319		Rel-13	UL gap applicability for CE Mode A	F	13.3.0	R1#87	R1-1613146	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.211	301	2	Rel-13	Clarification on i_0 value	F	13.3.0	R1#87	R1-1613148	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.213	804	_	Rel-14	Correction on DL CWS adjustment for LAA	A	14.0.0	R1#87	R1-1613181	LG Electronics, Intel	LTE_LAA-Core
36.213	805	_	Rel-14	Correction on aperiodic CSI only transmission for LAA SCell	F	14.0.0	R1#87	R1-1613182	LG Electronics	LTE_eLAA-Core
36.213	806		Rel-13	CR on RV Cycling for PDSCH	F	13.3.0	R1#87	R1-1613198	Huawei, HiSilicon, CATT	LTE_MTCe2_L1-Core
36.213	807		Rel-14	CR on RV Cycling for PDSCH	A	14.0.0	R1#87	R1-1613199	Huawei, HiSilicon, CATT	LTE_MTCe2_L1-Core
36.211	315	1	Rel-13	Correction on NPDSCH Mapping to resource elements in 36.211	F	13.3.0	R1#87	R1-1613202	Ericsson	NB_IOT-Core
36.211	316	1	Rel-14	Correction on NPDSCH Mapping to resource elements in 36.211	A	14.0.0	R1#87	R1-1613203	Ericsson	NB_IOT-Core
36.212	230	1	Rel-13	Correction on DCI Format N1 in 36.212	F	13.3.0	R1#87	R1-1613204	Ericsson	NB_IOT-Core
36.212	231	1	Rel-14	Correction on DCI Format N1 in 36.212	A	14.0.0	R1#87	R1-1613205	Ericsson	NB_IOT-Core
25.212	345	1	Rel-14	Introduction of multi-carrier enhancements for UMTS	B	13.1.0	R1#87	R1-1613207	Huawei, HiSilicon, Ericsson, Qualcomm	UTRA_MCe-Core
36.213	817		Rel-13	DCI for SPS	F	13.3.0	R1#87	R1-1613252	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.213	818		Rel-14	DCI for SPS	A	14.0.0	R1#87	R1-1613253	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.213	819		Rel-13	Number of MPDCCH-PRB sets	F	13.3.0	R1#87	R1-1613254	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.213	820		Rel-14	Number of MPDCCH-PRB sets	A	14.0.0	R1#87	R1-1613255	Qualcomm Incorporated	LTE_MTCe2_L1-Core
36.211	320		Rel-14	UL gap applicability for CE Mode A	A	14.0.0	R1#87	R1-1613256	Qualcomm Incorporated	LTE_MTCe2_L1-Core

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36.211	327	-	Rel-14	Mapping of MPDCCH and PDSCH	A	14.0.0	R1#87	R1-1613257	Sequans Communications, Qualcomm Incorporated, Samsung	LTE_MTCe2_L1-Core
36.213	814		Rel-14	PDSCH transmission on special subframe for eMTC	A	14.0.0	R1#87	R1-1613258	Nokia, Alcatel-Lucent Shanghai Bell	LTE_MTCe2_L1-Core
36.213	791	2	Rel-13	Corrections on the Table 16.6-2: Type 1- NPDCCH common search space candidates for NB-IoT in TS 36.213	F	13.3.0	R1#87	R1-1613259	Huawei, HiSilicon	NB_IOT-Core
36.213	792	2	Rel-14	Corrections on the Table 16.6-2: Type 1- NPDCCH common search space candidates for NB-IoT in TS 36.213	A	14.0.0	R1#87	R1-1613260	Huawei, HiSilicon	NB_IOT-Core
36.211	323		Rel-13	Clarification on vShift value for CRS	F	13.3.0	R1#87	R1-1613261	Qualcomm Incorporated	NB_IOT-Core
36.212	234	-	Rel-14	Corrections to bit padding of DCI format 1A for eLAA in TS36.212	F	14.0.0	R1#87	R1-1613283	Sharp	LTE_eLAA-Core
36.213	808	_	Rel-13	Correction on EPDCCH candidate configuration	F	13.3.0	R1#87	R1-1613338	Nokia, Alcatel-Lucent Shanghai Bell, LG Electronics	LTE_CA_enh_b5C-Core
36.213	815	0	Rel-14	CR on using 25us LBT for UEs on carriers without eNB Cat 4 LBT	F	14.0.0	R1#87	R1-1613482	Qualcomm Incorporated, Ericsson, Nokia, Broadcom, Wilus	LTE_eLAA-Core
36.213	816	0	Rel-14	CR on UL resource allocation for 10MHz LAA SCell	F	14.0.0	R1#87	R1-1613483	Qualcomm Incorporated	LTE_eLAA-Core
36.212	235	0	Rel-14	CR on UL resource allocation for 10MHz LAA SCell	F	14.0.0	R1#87	R1-1613484	Qualcomm Incorporated	LTE_eLAA-Core
36.212	236	-	Rel-14	Corrections to bit padding of DCI format 0B for eLAA in TS36.212	F	14.0.0	R1#87	R1-1613485	Sharp, Nokia	LTE_eLAA-Core
36.213	813	-	Rel-14	Draft CR on the UE assumption on multiple UL grants indicating a same subframe	F	14.0.0	R1#87	R1-1613486	Intel Corporation, Nokia, Alcatel-Lucent Shanghai Bell, Qualcomm, Samsung, Ericsson, LG Electronics, Huawei, HiSilicon, WILUS	LTE_eLAA-Core
36.213	811	0	Rel-14	CR on MCOT limits for carriers on which eNB performs Type B LBT	A	14.0.0	R1#87	R1-1613506	Qualcomm Incorporated	LTE_eLAA-Core
36.213	779	1	Rel-14	CR on trigger monitoring timeline for triggered grants in eLAA	F	14.0.0	R1#87	R1-1613509	Panasonic, Qualcomm Incorporated	LTE_eLAA-Core
36.213	802	1	Rel-14	CR on Multi-carrier LBT for Uplink Transmission	F	14.0.0	R1#87	R1-1613510	Ericsson	LTE_eLAA-Core
36.213	810	_	Rel-14	Correction on continuous transmission after the successful LBT	F	14.0.0	R1#87	R1-1613528	LG Electronics, WILUS	LTE_eLAA-Core
36.213	809	1	Rel-14	CR on UE assumption of LBT success for determining periodic CSI reporting	F	14.0.0	R1#87	R1-1613530	Qualcomm Incorporated	LTE_eLAA-Core
36.213	812		Rel-13	PDSCH transmission on special subframe for eMTC	F	13.3.0	R1#87	R1-1613559	Nokia, Alcatel-Lucent Shanghai Bell	LTE_MTCe2_L1-Core

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36.211	321	-	Rel-13	Draft CR on pseudo-random sequence generator for PUCCH format 4 and PUCCH format 5 and sequence group hopping for PUCCH format 4	F	13.3.0	R1#87	R1-1613643	Qualcomm Incorporated	LTE_CA_enh_b5C-Core
36.211	322	-	Rel-14	Draft CR on pseudo-random sequence generator for PUCCH format 4 and PUCCH format 5 and sequence group hopping for PUCCH format 4	A	14.0.0	R1#87	R1-1613644	Qualcomm Incorporated	LTE_CA_enh_b5C-Core
36.211	324		Rel-14	Clarification on vShift value for CRS	A	14.0.0	R1#87	R1-1613762	Qualcomm Incorporated	NB_IOT-Core
36.213	821	_	Rel-14	Correction on EPDCCH candidate configuration	F	14.0.0	R1#87	R1-1613766	LG Electronics, Nokia, Alcatel-Lucent Shanghai Bell	LTE_eLAA-Core
36.213	822	-	Rel-14	CR on applying TPC commands for UL grants in LAA	F	14.0.0	R1#87	R1-1613767	Qualcomm Incorporated, Sharp	LTE_eLAA-Core
36.211	325	-	Rel-13	Correction to OFDM baseband signal generation of NB-IoT	F	13.3.0	R1#87	R1-1613768	NEC, NTT DOCOMO, Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, Ericsson	NB_IoT-Core
36.211	326	-	Rel-14	Correction to OFDM baseband signal generation of NB-IoT	A	14.0.0	R1#87	R1-1613769	NEC, NTT DOCOMO, Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, Ericsson	NB_IoT-Core
36.213	823	0	Rel-14	CR on PHR reporting for triggered UL grants in LAA	F	14.0.0	R1#87	R1-1613771	Qualcomm Incorporated, Samsung, LG Electronics, Huawei, Hisilicon	LTE_eLAA-Core
36.213	825	-	Rel-13	Correction on NPDCCH and NPDSCH start symbol	F	13.3.0	R1#87	R1-1613776	Huawei, HiSilicon, Ericsson	NB_IOT-Core
36.213	826	-	Rel-14	Correction on NPDCCH and NPDSCH start symbol	A	14.0.0	R1#87	R1-1613777	Huawei, HiSilicon, Ericsson	NB_IOT-Core
36.213	781	2	Rel-14	CR on aperiodic CSI reporting for triggered UL grants in LAA	F	14.0.0	R1#87	R1-1613782	Qualcomm Incorporated	LTE_eLAA-Core
36.213	804	-	Rel-14	Correction on PDCCH candidate adjustments	F	14.0.0	R1#87	R1-1613181	Samsung	LTE_eLAA-Core
36.211	302	1	Rel-14	Clarification on i_0 value	A	14.0.0	R1#87	R1-1613251	Qualcomm Incorporated	LTE_MTCe2_L1-Core

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Annex C-1: List of Outgoing LSs from RAN1 #87

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1613208	LS to RAN2/3 on RAN1 progress on MC enhancements	RAN1, Huawei	Rel-14	UTRA_MCe-Core		RAN2, RAN3			
R1-1613330	LS on RRC parameters for PUSCH in UpPTS	RAN1, CMCC	Rel-14	LTE_UL_CAP_enh-Core		RAN2	RAN3, RAN4		
R1-1613331	LS on PUSCH in UpPTS	RAN1, CMCC	Rel-14	LTE_UL_CAP_enh-Core		RAN2, RAN3, RAN4			
R1-1613334	LS on possible RF impacts related to sPUSCH design	RAN1, Ericsson	Rel-15	LTE_sTTIandPT-Core		RAN4			
R1-1613348	Reply LS on RAN2 agreements for NR DL-based mobility and cell definition	RAN1, Samsung	Rel-14	FS_NR_newRAT	R2-167313	RAN2	RAN3, RAN4		
R1-1613468	LS on RSTD measurement for Rel-14 NB-IoT positioning	RAN1, Mediatek	Rel-14	NB_IOTenh-Core		RAN2, RAN4			
R1-1613481	LS for SRS Carrier-Based Switching Agreements	RAN1, Huawei	Rel-14	LTE_SRS_switch-Core		RAN2, RAN4			
R1-1613492	[DRAFT] Reply LS to RAN2 on capturing new numerology for TS.36.300	RAN1, Ericsson	Rel-14	MBMS_LTE_enh2-Core		RAN2			
R1-1613494	LS on MAC CE based activation/release mechanism for aperiodic and multi-shot CSI-RS	RAN1, Qualcomm	Rel-14	LTE_eFDMIMO-Core		RAN2			
R1-1613574	LS on long-term basis co-channel coexistence between DSRC/IEEE 802.11p and LTE PC5 for V2V operating over the same frequency channels	RAN1, Ericsson	Rel-14	LTE_V2X-Core		RAN			
R1-1613618	LS on MUST Higher Layer Signaling	RAN1, MediaTek	Rel-14	LTE_MUST-Core		RAN2			
R1-1613624	LS on Updated L1 parameters for SRS Carrier-Based Switching	RAN1, Huawei	Rel-14	LTE_SRS_switch-Core		RAN2	RAN4		
R1-1613629	LS on Text Proposal for TS 36.300 for SRS Carrier-Based Switching	RAN1, Huawei	Rel-14	LTE_SRS_switch-Core		RAN2			
R1-1613663	LS on UE RF Bandwidth Adaptation in NR	RAN1, MediaTek	Rel-14	FS_NR_newRAT		RAN4			
R1-1613692	LS on minimum system information	RAN1, LG Electronics	Rel-14	FS_NR_newRAT		RAN2			
R1-1613730	LS reply on coverage enhancement in SC-PTM for FeMTC and eNB-IoT	RAN1, Ericsson	Rel-14	LTE_feMTC-Core, NB_IOTenh-Core	R1-1611083	RAN2			
R1-1613731	LS reply on LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier	RAN1, Ericsson	Rel-14	NB_IOTenh-Core	R1-1611084	RAN2			

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1613748	LS on sub-carrier spacing and carrier frequency	RAN1, Ericsson	Rel-14	FS_NR_newRAT		RAN4			
R1-1613755	LS on agreement on OTDOA enhancement in RAN1#87	RAN1, Intel	Rel-14	UTRA_LTE_iPos_enh2-Core		RAN2, RAN3			
R1-1613757	LS on EVM assumption in MUST Case1/2 performance evaluations	Nokia, Alcatel-Lucent Shanghai Bell	Rel-14	LTE_MUST-Core		RAN4			
R1-1613758	LS regarding RAN1 agreements on FeMBMS	RAN1, Intel	Rel-14	MBMS_LTE_enh2-Core		RAN2	RAN4		
R1-1613760	LS on Rel-14 FeMTC OTDOA enhancements	RAN1, Ericsson	Rel-14	LTE_feMTC-Core		RAN2, RAN3, RAN4			
R1-1613761	LS on OTDOA agreements for NB-IoT	RAN1, Qualcomm	Rel-14	NB_IOTenh-Core		RAN2, RAN3, RAN4			
R1-1613763	LS on TBS and DCI formats for NB-IoT multicast	RAN1, HiSilicon	Rel-14	NB_IOTenh-Core		RAN2			
R1-1613764	LS on power consumption and latency reduction in NB-IoT	RAN1, Huawei	Rel-14	NB_IOTenh-Core		RAN2			
R1-1613765	LS reply on PHR for two-stage scheduling	RAN1, Huawei	Rel-14	LTE_eLAA-Core		RAN2			
R1-1613770	Response LS to IEEE 802.11 regarding LAA	RAN1, Qualcomm Incorporated	Rel-13	LTE_LAA-Core	IEEE EC-16-0140-01-00EC (R1-167908)	IEEE 802 LAN/MAN Standards Committee	Wi-Fi Alliance, The City of New York Office of the Mayor, RAN, RAN2, RAN4		
R1-1613778	Response LS on resource reservation issues	RAN1, LG Electronics	Rel-14	LTE_SL_V2V-Core	R2-168932	RAN2			

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Annex C-2: List of Incoming LSs from RAN1 #87

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1611082	Characteristics of terrestrial IMT systems for frequency sharing / interference analysis in the frequency range between 24.25 GHz and 86 GHz	ITU-R WP 5D	Rel-14	FS_NR_newRAT		RAN1		LS_EOs_5D_374Att4.13	
R1-1611083	LS on coverage enhancement in SC-PTM for FeMTC and eNB-IoT	RAN2, Ericsson	Rel-14	LTE_feMTC-Core, NB_IOTenh-Core		RAN1	RAN3	R2-167234	R1-1613730
R1-1611084	LS on NB-IoT Rel-14 RACH and Paging on non-anchor carrier	RAN2, Ericsson	Rel-14	NB_IOTenh-Core		RAN1		R2-167235	R1-1613731
R1-1611085	LS on supporting PHR for two-stage scheduling	RAN2, Huawei	Rel-14	LTE_eLAA-Core		RAN1		R2-167302	
R1-1611086	LS on capabilities for 2-step scheduling for eLAA	RAN2, Ericsson	Rel-14	LTE_eLAA-Core		RAN1		R2-167307	
R1-1611087	LS on RAN2 agreements for mobility enhancement	RAN2, Intel	Rel-14	LTE_eMob-Core		RAN3	RAN1, RAN4	R2-167312	
R1-1611088	LS on RAN2 agreements for NR DL-based mobility and Cell definition	RAN2, Ericsson	Rel-14	FS_NR_newRAT		RAN1	RAN3, RAN4	R2-167313	
R1-1611089	Response LS on Category M1 UE and VoLTE	RAN2, Ericsson	Rel-14	FS_LTE_eVoLTE	R5-167215	RAN5	RAN1, GSMA NG, GSMA RILTE	R2-167316	
R1-1611090	Response LS on Measurement gap enhancement	RAN2, Ericsson	Rel-14	LTE_meas_gap_enh-Core	R4-167024	RAN4	RAN1	R2-167317	
R1-1611091	Reply LS on blind detection evaluations	RAN4, MediaTek	Rel-14	LTE_MUST-Core		RAN1		R4-168660	
R1-1611092	LS on SRS switching time reporting	RAN4, Huawei	Rel-14	LTE_SRS_switch-Core		RAN2	RAN1	R4-168955	
R1-1611093	LS on SSTD report mapping	RAN4, CATT	Rel-13	LTE_dualC_enh-Core		RAN2	RAN1, RAN5	R4-168956	
R1-1611094	LS response on Network Assistance for Network Synchronization in LTE	RAN4, Huawei	Rel-14	FS_LTE_NW_SYNC		RAN, RAN3	RAN1	R4-168957	
R1-1611444	LS on Multi-carrier enhancements for UMTS	RAN2, Ericsson	Rel-14	UTRA_Mce-Core		RAN4	RAN1	R2-167169	
R1-1611445	LS on TTI switching for MC enhancements	RAN2, Huawei	Rel-14	UTRA_Mce-Core		RAN1, RAN3		R2-167171	
R1-1611446	LS to RAN1 on V2V agreements	RAN2, LGE	Rel-14	LTE_SL_V2V-Core		RAN1		R2-167188	
R1-1611447	LS Response on introducing a new special subframe configuration	RAN3, CATT	Rel-14	LTE_UL_CAP_enh-Core	R1-168559	RAN1, RAN2		R3-162612	

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-1611448	Response LS on the Make Before Break solution	RAN3, ZTE	Rel-14	LTE_eMob-Core	R2-165969	RAN2	RAN1, RAN4	R3-162646	
R1-1611449	LS on Category M1 UE and VoLTE	RAN5, Ericsson	Rel-14	FS_LTE_eVoLTE		RAN2	RAN1, GSMA NG, GSMA RILTE	R5-167215	
R1-1611450	LS on NextGen QoS interim agreements	SA2, Intel	Rel-14	FS_NextGen		RAN2, RAN3	RAN1	S2-166289	
R1-1611451	Requirements for mobile backhaul/fronthaul in a G.fast Deployment Environment	ITU-T Study Group 15	Rel-14	FS_NR_newRAT		RAN1, RAN4		COM 15 – LS 405 – E	
R1-1611452	Reply LS on QoS requirements for V2X	SA1, Qualcomm	Rel-14	V2XARC	S2-164927	SA2, RAN2, CT1	RAN1, RAN3	S1-163425	
R1-1613126	IEEE 802 LMSC response LS on energy detection threshold in future 802.11 technologies	IEEE 802 LMSC	Rel-13	LTE_LAA-Core		RAN1	RAN	IEEE EC-16-0203-00-00EC	
R1-1613316	Response LS on Use of Exceptional Pool	RAN2, LGE	Rel-14	LTE_SL_V2V-Core	R1-1610930	RAN1		R2-168931	
R1-1613317	LS to RAN1 on resource reservation issues	RAN2, LGE	Rel-14	LTE_SL_V2V-Core		RAN1		R2-168932	
R1-1613446	Reply LS for Voice and Video enhancement for LTE	RAN2, Huawei	Rel-14	LTE_VoLTE_ViLTE_enh-Core	R1-1611057	RAN1		R2-168949	
R1-1613592	LS on RAN2 agreements on FeMBMS	RAN2, Ericsson	Rel-14	MBMS_LTE_enh2-Core				R2-168951	

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Annex D: List of Approved updated WIDs

None

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Annex E: **List of draft TSs/TRs agreed at RAN1 #87**

Tdoc Number	Title	Source	Conclusion/Decision
R1-1613687	TR 38.802 v1.0.0 Study on New Radio (NR) Access Technology - Physical Layer Aspects	NTT DOCOMO, INC.	Endorsed

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Annex F: List of actions

- **Outgoing LS.**

[87-01] Karri (Nokia)
R1-1613773 Reply LS on Requirements for mobile backhaul/fronthaul in a G.fast Deployment Environment Nokia
Email approval until 24th Nov.
Done: .

[87-14] Hanbyul (LGE)
LS of V2X (Agreement list)
Email approval until 8th Dec on the LS to RAN2/4 capturing all the agreements and working assumptions

[87-15] Hanbyul (LGE)
LS of V2X (RRC parameter list)
Email approval until 8th Dec on the LS to RAN2 including RRC parameters

- **CR approval**

[87-02] Srinivas (Qualcomm)
R1-1611580 Draft CR for maximum timing advance assumptions for LAA and relation to UL grants
Email approval until RAN1#88

[87-03] Editors
MUST CR
Editors will provide updated draft CRs for MUST including agreements and WA until Tues 22nd Nov, and email approval until Mon 28th Nov.
Rapporteur will provide agreement lists until Friday 18th Nov.

[87-04] Editors
SRS CR
Editors will provide updated draft CRs for SRS including agreements and WA until Tues 22nd Nov, and email approval until Mon 28th Nov.
Rapporteur will provide agreement lists until Friday 18th Nov.

[87-05] Editors
V2V CR
Editors will provide updated draft CRs for V2V including agreements and WA until Tues 22nd Nov, and email approval until Mon 28th Nov.
Rapporteur will provide agreement lists until Friday 18th Nov.

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[87-06] Editors
High Speed CR
Editors will provide updated draft CRs for High Speed including agreements and WA until Tues 22nd Nov, and email approval until Mon 28th Nov.
Rapporteur will provide agreement lists until Friday 18th Nov.

[87-07] Editors
UL cap. enh. CR
Editors will provide draft CRs for UL enhancements including agreements and WA until 9th Dec, and email approval until Thurs 15th Dec.
Rapporteur will provide agreement lists until Mon 21st Nov.

[87-08] Editors
eMBMS CR
Editors will provide draft CRs for eMBMS including agreements and WA until 9th Dec, and email approval until Thurs 15th Dec.
Rapporteur will provide agreement lists until Mon 21st Nov.

[87-09] Editors
V2X CR
Editors will provide draft CRs for V2X including agreements and WA until Fri Jan 27th.
Editors may update draft CRs for comments received until RAN1#88 Athens.
Rapporteur will provide agreement lists until Thurs 15th Dec.

[87-10] Editors
eFD-MIMO CR
Editors will provide draft CRs for eFD-MIMO including agreements and WA until Fri Jan 27th.
Editors may update draft CRs for comments received until RAN1#88 Athens.
Rapporteur will provide agreement lists until Thurs 15th Dec.

[87-11] Editors
FeMTC CR
Editors will provide draft CRs for FeMTC including agreements and WA until Fri Jan 27th.
Editors may update draft CRs for comments received until RAN1#88 Athens.
Rapporteur will provide agreement lists until Thurs 15th Dec.

[87-12] Editors
NB-IoT enh. CR
Editors will provide draft CRs for NB-IoT enh. including agreements and WA until Fri Jan 27th.
Editors may update draft CRs for comments received until RAN1#88 Athens.
Rapporteur will provide agreement lists until Thurs 15th Dec.

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[87-13] Editors
eVoLTE
Editors will provide draft CRs for eVoLTE including agreements and WA until Fri Jan 27th.
Editors may update draft CRs for comments received until RAN1#88 Athens.
Rapporteur will provide agreement lists until Thurs 15th Dec.

- **Text proposal for TS and TR**

None

- **Miscellaneous**

[87-16] Yi (Huawei)
Congention control for V2X (1)
Email approval until 1st Dec on the working assumption and [1000]ms

[87-17] Hanbyul (LGE)
Congention control for V2X (2)
Email discussion until RAN1#88 on the FFS points in the congestion control

[87-18] Yi (Huawei)
UE behaviour for V2X
Email approval until 1st Dec on the UE behaviour with the following starting points

[87-19] Seungmin (LGE)
V2V synchronization
Email approval until 1st Dec on this proposal

[87-20] Eko (Samsung)
RRC parameter list of eFD-MIMO
Email approval until 1st Dec, then send LS to RAN2 – Eko, Samsung

[87-21] Jonghyun (LGE)
QCL for eFD-MIMO
Email approval until Wed 23rd Nov.

[87-22] Mark (Ericsson)

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R1-1613608 Way Forward on text proposal for gray mapping and power allocation Huawei, HiSilicon, SONY
To update the CR regarding spatial layer power allocation and/or Gray mapping for email approval till 11/22

[87-23] Johan (Ericsson)
RRC parameter list of FeMTC
Email approval of RRC parameter lists until 24th Nov.

[87-24] Matthew (Huawei)
RRC parameter list of NB-IoT enh.
Email approval for the higher layer parameters list and send to RAN2 until November 25

[87-25] Xia Yuan (Huawei)
sTTI scheduling
Email discussion until 18th Jan. of sTTI scheduling (e.g., R1-1613373 and R1-1613422) – Xia Yuan (Huawei)

[87-26] Yu Bo (Huawei)
RRC parameter list of eVoLTE
Email approval of RRC parameter lists until 1st Dec.

[87-27] Yeohun (Samsung)
Potential solution of eMBB and URLLC Multiplexing
Email discussion until 8th Dec. to list the potential solution – Yeohun (Samsung)

[87-28] Hyunsoo (LGE)
DMRS design for DL data channel for NR
To collect companies proposals on DMRS design for DL data channel for NR to facilitate evaluation for the next RAN1 meetings till 8th Dec.

[87-29] Hyunsoo (LGE)
Simulation assumption for NR DMRS
To discussion/agree on simulation assumptions till 15th Dec.

[87-30] Ruyue (ZTE)
NR MIMO Calibration
Email (till next meeting) to collect additional phase 1 and phase 2 simulation results and clarify simulation assumptions, if any

[87-31] Stefan (Ericsson)
DL L1/L2 control channel design for NR
Email discussion until 11th Jan.

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[87-32] Fred (NTT DOCOMO)
UL L1/L2 control channel design for NR
Email discussion until 11th Jan.

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3GPP TSG RAN WG1 Meeting #88 **R1-17xxxxx**
Athens, Greece, 13th – 17th February 2017

Annex G: List of participants at RAN1 #87

Please see excel file attached to this report

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3GPP TSG RAN WG1 Meeting #88 **R1-17xxxxx**
Athens, Greece, 13th – 17th February 2017

Annex H: **TSG RAN WG1 meetings in 2017 – 2018**

TITLE	TYPE	DATES	LOCATION	CTRY
3GPPRAN1-NR	AH	16 – 20 Jan 2017	Spokane	US
3GPPRAN1#88	WG	13 – 17 Feb 2017	Athens	Greece
3GPPRAN1#88bis	WG	03 – 07 Apr 2017	TBD	US
3GPPRAN1#89	WG	15 – 19 May 2017	TBD	China
3GPPRAN1-NR	AH	27 – 30 Jun 2017	TBD	China
3GPPRAN1#90	WG	21 – 25 Aug 2017	Prague	Rep Czech
3GPPRAN1-NR	AH	18 – 21 Sep 2017	TBD	TBD
3GPPRAN1#90bis	WG	09 – 13 Oct 2017	Prague	Rep Czech
3GPPRAN1#91	WG	27 Nov – 01 Dec 2017	TBD	US
3GPPRAN1#92	WG	26 Feb – 2 Mar 2018	Athens (TBC)	Greece
3GPPRAN1#92bis	WG	16 – 20 Apr 2018	TBD	TBD
3GPPRAN1#93	WG	21 – 25 May 2018	TBD	TBD
3GPPRAN1#94	WG	20 – 24 Aug 2018	Gothenburg (TBC)	Sweden
3GPPRAN1#94bis	WG	8 – 12 Oct 2018	TBD	TBD
3GPPRAN1#95	WG	12 – 16 Nov 2018	TBD	TBD

MEETING TYPES		
AH = Ad Hoc	ST = Startup Meeting	RG = Rapporteurs Group
JM = Joint	WG = Working Group	SG = Steering Group
PM = Preparatory Meeting	CM = Chairmen's meeting	TG = Task Group
RM = Resolution Meeting	OR = Ordinary	XO = Extraordinary

End of document

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APPENDIX 27

www.3gpp.org / ftp / tsg_ran / WG1_RL1 / TSGR1_84b / Docs

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R1-162206.zip	2016/04/02 5:56	252,6 KB
R1-162207.zip	2016/04/02 5:56	597,2 KB
R1-162208.zip	2016/04/02 6:07	88,3 KB
R1-162209.zip	2016/04/02 5:29	203,8 KB
R1-162210.zip	2016/04/02 6:07	152 KB
R1-162211.zip	2016/04/02 5:29	139 KB
R1-162212.zip	2016/04/02 5:29	119,7 KB
R1-162213.zip	2016/04/02 5:29	104,6 KB
R1-162214.zip	2016/04/02 5:29	78,8 KB
R1-162215.zip	2016/04/02 5:34	48,7 KB
R1-162216.zip	2016/04/02 6:11	70,9 KB
R1-162217.zip	2016/04/06 15:13	785,3 KB
R1-162218.zip	2016/04/01 16:17	60,7 KB
R1-162219.zip	2016/04/01 16:17	122 KB
R1-162220.zip	2016/04/01 16:17	43,9 KB
R1-162221.zip	2016/04/01 16:17	410,4 KB
R1-162222.zip	2016/04/01 16:18	124,8 KB
R1-162223.zip	2016/04/01 16:18	247,8 KB
R1-162224.zip	2016/04/01 16:18	57,5 KB
R1-162225.zip	2016/04/01 16:18	327,6 KB
R1-162226.zip	2016/04/01 16:19	328,1 KB
R1-162227.zip	2016/04/01 16:19	121,1 KB
R1-162228.zip	2016/04/01 16:19	266,7 KB
R1-162229.zip	2016/04/01 16:19	181,3 KB
R1-162230.zip	2016/04/01 16:20	555,7 KB
R1-162231.zip	2016/04/02 3:57	137 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162232.zip	2016/04/02 3:57	274,8 KB
R1-162233.zip	2016/04/02 3:57	738,1 KB
R1-162234.zip	2016/04/02 3:57	1725,9 KB
R1-162235.zip	2016/04/02 6:48	31,5 KB
R1-162236.zip	2016/04/02 6:48	20 KB
R1-162237.zip	2016/04/02 3:57	170,8 KB
R1-162238.zip	2016/04/02 4:08	181 KB
R1-162239.zip	2016/04/02 6:36	58,7 KB
R1-162240.zip	2016/04/02 6:36	52,2 KB
R1-162241.zip	2016/04/02 1:17	91,7 KB
R1-162242.zip	2016/04/02 1:18	624,2 KB
R1-162243.zip	2016/04/02 1:18	489 KB
R1-162244.zip	2016/04/02 1:18	482,6 KB
R1-162245.zip	2016/04/02 1:17	185,8 KB
R1-162246.zip	2016/04/02 1:17	109,3 KB
R1-162247.zip	2016/04/02 1:17	230,5 KB
R1-162248.zip	2016/04/01 0:14	518,2 KB
R1-162249.zip	2016/04/01 0:14	35,2 KB
R1-162250.zip	2016/04/01 18:54	39 KB
R1-162251.zip	2016/04/01 18:54	44,2 KB
R1-162252.zip	2016/04/01 18:54	47,4 KB
R1-162253.zip	2016/04/02 4:25	153,6 KB
R1-162254.zip	2016/04/02 4:25	82,1 KB
R1-162256.zip	2016/04/02 4:25	34,5 KB
R1-162258.zip	2016/04/02 4:26	169,5 KB
R1-162259.zip	2016/04/02 2:01	274,4 KB
R1-162260.zip	2016/04/02 2:01	584,6 KB
R1-162261.zip	2016/04/02 2:01	228,6 KB
R1-162262.zip	2016/04/02 2:01	114,6 KB
R1-162263.zip	2016/04/02 2:01	136,5 KB
R1-162264.zip	2016/04/02 2:02	52,2 KB
R1-162265.zip	2016/04/02 2:02	87,8 KB
R1-162266.zip	2016/04/02 2:02	53,4 KB
R1-162267.zip	2016/04/02 2:02	125,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162268.zip	2016/04/02 3:17	68,8 KB
R1-162269.zip	2016/04/02 2:02	42,8 KB
R1-162270.zip	2016/04/02 1:59	98 KB
R1-162271.zip	2016/04/02 1:59	45,5 KB
R1-162272.zip	2016/04/02 1:59	212,3 KB
R1-162273.zip	2016/04/02 1:59	48,5 KB
R1-162274.zip	2016/04/02 1:59	158,6 KB
R1-162275.zip	2016/04/02 1:59	51,6 KB
R1-162276.zip	2016/04/02 1:59	1085,5 KB
R1-162277.zip	2016/04/02 1:59	388,1 KB
R1-162278.zip	2016/04/02 1:59	72,7 KB
R1-162279.zip	2016/04/02 1:59	69 KB
R1-162280.zip	2016/04/02 1:59	104,5 KB
R1-162281.zip	2016/04/02 1:59	28,8 KB
R1-162282.zip	2016/04/02 1:59	25,6 KB
R1-162283.zip	2016/04/02 1:59	36,3 KB
R1-162284.zip	2016/04/02 1:59	61,4 KB
R1-162285.zip	2016/04/02 1:59	177,5 KB
R1-162286.zip	2016/04/02 1:59	77,2 KB
R1-162287.zip	2016/04/02 1:59	28,5 KB
R1-162288.zip	2016/04/02 2:00	112 KB
R1-162289.zip	2016/04/02 2:00	162,1 KB
R1-162290.zip	2016/04/02 2:00	29,4 KB
R1-162291.zip	2016/04/02 2:00	31,5 KB
R1-162292.zip	2016/04/02 2:00	185,6 KB
R1-162293.zip	2016/04/02 3:17	268,2 KB
R1-162294.zip	2016/04/02 3:17	69,6 KB
R1-162295.zip	2016/04/02 2:00	47,5 KB
R1-162296.zip	2016/04/02 2:00	116,1 KB
R1-162297.zip	2016/04/02 2:00	175,2 KB
R1-162298.zip	2016/04/02 5:26	68,9 KB
R1-162299.zip	2016/04/02 5:26	409,6 KB
R1-162300.zip	2016/04/02 5:26	268,4 KB
R1-162301.zip	2016/04/02 2:00	53,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162302.zip	2016/04/02 2:00	52,4 KB
R1-162303.zip	2016/04/02 2:00	407,1 KB
R1-162304.zip	2016/04/02 2:00	43,9 KB
R1-162305.zip	2016/04/02 2:00	55,4 KB
R1-162306.zip	2016/04/02 2:00	137,3 KB
R1-162307.zip	2016/04/02 4:26	68 KB
R1-162308.zip	2016/04/02 2:00	61,7 KB
R1-162309.zip	2016/04/02 4:26	84,3 KB
R1-162310.zip	2016/04/02 2:01	123,3 KB
R1-162311.zip	2016/04/02 2:01	62,3 KB
R1-162313.zip	2016/04/02 2:01	164,2 KB
R1-162314.zip	2016/04/02 2:01	152,5 KB
R1-162315.zip	2016/04/02 2:01	72,5 KB
R1-162316.zip	2016/04/02 2:01	141,7 KB
R1-162317.zip	2016/04/02 2:01	58,2 KB
R1-162318.zip	2016/04/01 6:05	284,6 KB
R1-162319.zip	2016/04/01 6:05	267,1 KB
R1-162320.zip	2016/04/01 16:48	71,8 KB
R1-162321.zip	2016/04/01 16:49	86,1 KB
R1-162322.zip	2016/04/01 16:49	94,9 KB
R1-162323.zip	2016/04/01 16:45	21,9 KB
R1-162324.zip	2016/04/01 16:50	103,4 KB
R1-162325.zip	2016/04/01 16:52	148,6 KB
R1-162326.zip	2016/04/01 16:52	129,1 KB
R1-162327.zip	2016/04/01 16:53	158,5 KB
R1-162328.zip	2016/04/01 16:45	68,5 KB
R1-162329.zip	2016/04/01 16:46	194,4 KB
R1-162330.zip	2016/04/01 16:59	852,9 KB
R1-162331.zip	2016/04/01 16:54	145,4 KB
R1-162332.zip	2016/04/01 16:54	48,8 KB
R1-162333.zip	2016/04/01 16:54	252,2 KB
R1-162334.zip	2016/04/01 16:54	54,5 KB
R1-162335.zip	2016/04/01 16:54	130,7 KB
R1-162336.zip	2016/04/01 6:05	226,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162337.zip	2016/04/01 6:05	45 KB
R1-162338.zip	2016/04/01 6:05	46,2 KB
R1-162339.zip	2016/04/01 6:05	131,2 KB
R1-162340.zip	2016/04/01 6:05	43 KB
R1-162341.zip	2016/04/04 9:10	17,1 KB
R1-162342.zip	2016/04/04 9:10	28,7 KB
R1-162343.zip	2016/04/02 8:40	148,8 KB
R1-162344.zip	2016/04/02 8:40	17,3 KB
R1-162345.zip	2016/04/02 8:40	634,8 KB
R1-162346.zip	2016/04/02 9:26	157,7 KB
R1-162347.zip	2016/04/02 8:40	93 KB
R1-162348.zip	2016/04/02 8:40	90,9 KB
R1-162349.zip	2016/04/02 8:40	60,7 KB
R1-162350.zip	2016/04/02 8:40	118 KB
R1-162351.zip	2016/04/02 6:10	383,4 KB
R1-162352.zip	2016/04/02 6:10	103,4 KB
R1-162353.zip	2016/04/02 6:10	308,4 KB
R1-162354.zip	2016/04/02 6:10	86,9 KB
R1-162355.zip	2016/04/02 6:10	100,6 KB
R1-162356.zip	2016/04/02 6:10	86,3 KB
R1-162357.zip	2016/04/02 6:10	240 KB
R1-162358.zip	2016/04/02 6:10	209,7 KB
R1-162359.zip	2016/04/02 6:10	433 KB
R1-162360.zip	2016/04/02 6:10	488,6 KB
R1-162361.zip	2016/04/02 6:11	377,4 KB
R1-162362.zip	2016/04/02 6:11	441 KB
R1-162363.zip	2016/04/02 6:11	1165,8 KB
R1-162364.zip	2016/04/02 6:11	301,9 KB
R1-162365.zip	2016/04/02 6:11	889,1 KB
R1-162366.zip	2016/04/02 6:12	156 KB
R1-162367.zip	2016/04/02 6:12	91,8 KB
R1-162368.zip	2016/04/02 6:12	86 KB
R1-162369.zip	2016/04/02 6:12	141,4 KB
R1-162370.zip	2016/04/02 6:12	92,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162371.zip	2016/04/02 6:12	71 KB
R1-162372.zip	2016/04/02 6:12	53,1 KB
R1-162373.zip	2016/04/02 6:12	714,9 KB
R1-162374.zip	2016/04/02 6:12	327,8 KB
R1-162375.zip	2016/04/02 6:12	410,6 KB
R1-162376.zip	2016/04/02 6:13	397,5 KB
R1-162377.zip	2016/04/02 6:13	132,1 KB
R1-162378.zip	2016/04/02 6:12	46,8 KB
R1-162379.zip	2016/04/02 6:12	54,8 KB
R1-162380.zip	2016/04/02 6:12	665,7 KB
R1-162381.zip	2016/04/02 6:13	47,6 KB
R1-162382.zip	2016/04/02 6:13	543,6 KB
R1-162383.zip	2016/04/02 6:13	291,9 KB
R1-162384.zip	2016/04/02 6:13	106,5 KB
R1-162385.zip	2016/04/02 6:13	136,1 KB
R1-162386.zip	2016/04/02 6:13	89,6 KB
R1-162387.zip	2016/04/02 6:13	91 KB
R1-162388.zip	2016/04/02 6:13	202,7 KB
R1-162389.zip	2016/04/02 6:13	449,4 KB
R1-162390.zip	2016/04/02 9:45	64,1 KB
R1-162391.zip	2016/04/01 16:54	47,2 KB
R1-162392.zip	2016/04/01 16:54	32,9 KB
R1-162393.zip	2016/04/01 16:54	31,5 KB
R1-162394.zip	2016/04/01 16:54	53,8 KB
R1-162395.zip	2016/04/01 16:54	135,5 KB
R1-162396.zip	2016/04/01 16:54	72 KB
R1-162397.zip	2016/04/02 5:13	66,7 KB
R1-162398.zip	2016/04/02 6:17	101,6 KB
R1-162399.zip	2016/04/02 6:17	213,7 KB
R1-162400.zip	2016/04/02 6:17	106,9 KB
R1-162401.zip	2016/04/02 6:17	157,4 KB
R1-162402.zip	2016/04/02 6:17	173,5 KB
R1-162403.zip	2016/04/02 6:17	251,5 KB
R1-162404.zip	2016/04/02 6:17	100 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162405.zip	2016/04/02 6:17	155,1 KB
R1-162406.zip	2016/04/02 6:17	275,9 KB
R1-162407.zip	2016/04/02 6:17	228,5 KB
R1-162408.zip	2016/04/02 6:17	118,6 KB
R1-162409.zip	2016/04/02 6:17	265 KB
R1-162410.zip	2016/04/02 6:17	92,8 KB
R1-162411.zip	2016/04/02 6:17	53,8 KB
R1-162412.zip	2016/04/02 6:17	120,1 KB
R1-162413.zip	2016/04/02 6:17	70 KB
R1-162414.zip	2016/04/02 6:17	56,1 KB
R1-162415.zip	2016/04/01 13:17	130,9 KB
R1-162416.zip	2016/04/02 6:17	182,9 KB
R1-162417.zip	2016/04/01 13:19	87,2 KB
R1-162418.zip	2016/04/01 13:19	59 KB
R1-162419.zip	2016/04/01 13:17	100,7 KB
R1-162420.zip	2016/04/01 13:17	66,3 KB
R1-162421.zip	2016/04/01 3:31	389,5 KB
R1-162422.zip	2016/04/02 4:26	35,1 KB
R1-162423.zip	2016/04/02 3:12	243,2 KB
R1-162424.zip	2016/04/02 3:12	74,4 KB
R1-162425.zip	2016/04/01 9:47	58,6 KB
R1-162426.zip	2016/04/01 3:15	31,2 KB
R1-162427.zip	2016/04/01 3:15	33,2 KB
R1-162428.zip	2016/04/01 3:15	43,9 KB
R1-162429.zip	2016/04/01 3:15	40,9 KB
R1-162430.zip	2016/04/01 3:15	66,4 KB
R1-162431.zip	2016/04/01 3:15	197,4 KB
R1-162432.zip	2016/04/01 3:15	25,6 KB
R1-162433.zip	2016/04/01 3:15	54,2 KB
R1-162434.zip	2016/04/01 3:15	27,3 KB
R1-162435.zip	2016/04/01 3:15	1042,1 KB
R1-162436.zip	2016/04/01 3:15	38,3 KB
R1-162437.zip	2016/04/01 3:15	198 KB
R1-162438.zip	2016/04/01 3:15	151,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162439.zip	2016/04/01 3:15	83,4 KB
R1-162440.zip	2016/04/01 3:15	66,2 KB
R1-162441.zip	2016/04/01 3:15	65,9 KB
R1-162442.zip	2016/04/01 3:15	86,1 KB
R1-162443.zip	2016/04/01 3:15	69,9 KB
R1-162444.zip	2016/04/01 3:15	48,8 KB
R1-162445.zip	2016/04/01 3:15	83,4 KB
R1-162446.zip	2016/04/01 3:15	79,4 KB
R1-162447.zip	2016/04/02 8:40	42,2 KB
R1-162448.zip	2016/04/02 9:55	28,4 KB
R1-162449.zip	2016/04/02 3:32	34,1 KB
R1-162450.zip	2016/04/02 3:32	28,8 KB
R1-162451.zip	2016/04/02 3:32	65,3 KB
R1-162452.zip	2016/04/02 3:32	73,4 KB
R1-162453.zip	2016/04/02 3:32	27,3 KB
R1-162454.zip	2016/04/02 3:32	26,7 KB
R1-162455.zip	2016/04/02 3:32	32 KB
R1-162456.zip	2016/04/02 3:32	26,4 KB
R1-162457.zip	2016/04/02 3:32	40,1 KB
R1-162458.zip	2016/04/06 5:10	84,9 KB
R1-162459.zip	2016/04/06 5:10	38,4 KB
R1-162460.zip	2016/04/06 5:10	112,5 KB
R1-162461.zip	2016/04/06 5:10	32,3 KB
R1-162462.zip	2016/04/06 5:10	53,9 KB
R1-162463.zip	2016/04/06 5:10	70,9 KB
R1-162464.zip	2016/04/06 5:10	70,4 KB
R1-162465.zip	2016/04/02 3:33	59,6 KB
R1-162466.zip	2016/04/02 3:33	38,6 KB
R1-162467.zip	2016/04/02 3:33	48,8 KB
R1-162468.zip	2016/04/02 3:33	152,3 KB
R1-162469.zip	2016/04/02 3:33	88,2 KB
R1-162470.zip	2016/04/02 3:33	36,6 KB
R1-162471.zip	2016/04/02 3:33	30,4 KB
R1-162472.zip	2016/04/02 3:33	237,2 KB

sort by name/desc	sort by date/desc	sort by size/desc
R1-162473.zip	2016/04/02 3:33	219,9 KB
R1-162474.zip	2016/04/02 3:33	275,5 KB
R1-162475.zip	2016/04/02 3:34	28,6 KB
R1-162476.zip	2016/04/02 3:34	28,8 KB
R1-162477.zip	2016/04/02 5:23	216,3 KB
R1-162478.zip	2016/04/02 5:23	106,8 KB
R1-162479.zip	2016/04/02 5:23	62,6 KB
R1-162480.zip	2016/04/06 16:29	138,1 KB
R1-162481.zip	2016/04/02 5:23	70,8 KB
R1-162482.zip	2016/04/02 5:23	59,2 KB
R1-162483.zip	2016/04/02 5:23	107,6 KB
R1-162484.zip	2016/04/02 5:23	60,6 KB
R1-162485.zip	2016/04/02 5:23	59,7 KB
R1-162486.zip	2016/04/02 5:23	65,9 KB
R1-162487.zip	2016/04/02 3:34	189,7 KB
R1-162488.zip	2016/04/02 3:34	55,5 KB
R1-162489.zip	2016/04/02 3:34	32,3 KB
R1-162490.zip	2016/04/02 3:34	71,2 KB
R1-162491.zip	2016/04/02 3:34	32,9 KB
R1-162492.zip	2016/04/02 3:34	44,3 KB
R1-162493.zip	2016/04/02 3:34	101,9 KB
R1-162494.zip	2016/04/02 3:34	136 KB
R1-162495.zip	2016/04/02 3:36	76,2 KB
R1-162496.zip	2016/04/02 4:56	629,5 KB
R1-162497.zip	2016/04/02 4:56	93,8 KB
R1-162499.zip	2016/04/02 4:56	41,6 KB
R1-162500.zip	2016/04/02 4:56	54,2 KB
R1-162501.zip	2016/04/02 4:56	38,1 KB
R1-162502.zip	2016/04/02 4:57	41 KB
R1-162503.zip	2016/04/02 3:36	497,8 KB
R1-162504.zip	2016/04/02 3:36	799,2 KB
R1-162505.zip	2016/04/02 3:36	433,8 KB
R1-162506.zip	2016/04/02 3:36	481,5 KB
R1-162507.zip	2016/04/02 3:36	384,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162508.zip	2016/04/02 3:36	254,6 KB
R1-162509.zip	2016/04/02 3:36	163,8 KB
R1-162510.zip	2016/04/02 3:36	83 KB
R1-162511.zip	2016/04/02 3:37	73,1 KB
R1-162512.zip	2016/04/02 3:37	152,2 KB
R1-162513.zip	2016/04/02 3:37	34,8 KB
R1-162514.zip	2016/04/02 3:37	32,9 KB
R1-162515.zip	2016/04/02 3:37	33,9 KB
R1-162516.zip	2016/04/02 3:37	183,3 KB
R1-162517.zip	2016/04/02 3:37	55,4 KB
R1-162518.zip	2016/04/02 3:37	33,5 KB
R1-162519.zip	2016/04/02 3:37	181,1 KB
R1-162520.zip	2016/04/02 3:37	31,2 KB
R1-162521.zip	2016/04/02 3:37	36,5 KB
R1-162522.zip	2016/04/02 3:37	170,4 KB
R1-162523.zip	2016/04/02 3:37	75,7 KB
R1-162524.zip	2016/04/02 3:37	39,5 KB
R1-162525.zip	2016/04/02 3:38	50,7 KB
R1-162526.zip	2016/04/02 3:38	39,5 KB
R1-162527.zip	2016/04/01 12:04	21,3 KB
R1-162528.zip	2016/04/01 12:05	107,8 KB
R1-162529.zip	2016/04/02 2:06	31,7 KB
R1-162530.zip	2016/04/02 2:06	30,9 KB
R1-162531.zip	2016/04/01 10:38	136,7 KB
R1-162532.zip	2016/04/01 10:38	83,7 KB
R1-162533.zip	2016/04/01 10:38	73,9 KB
R1-162534.zip	2016/04/01 10:38	103,6 KB
R1-162535.zip	2016/04/01 10:38	75 KB
R1-162536.zip	2016/04/01 10:38	281,7 KB
R1-162537.zip	2016/04/01 16:26	1500,8 KB
R1-162538.zip	2016/04/01 22:07	122,4 KB
R1-162539.zip	2016/04/01 22:07	70 KB
R1-162540.zip	2016/04/01 22:07	51,6 KB
R1-162541.zip	2016/04/01 22:07	160,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162542.zip	2016/04/01 22:08	144,9 KB
R1-162543.zip	2016/04/01 10:56	132,7 KB
R1-162544.zip	2016/04/01 10:56	87,6 KB
R1-162545.zip	2016/04/01 10:56	135,8 KB
R1-162546.zip	2016/04/01 10:56	96,3 KB
R1-162547.zip	2016/04/01 10:56	67,9 KB
R1-162548.zip	2016/04/01 10:56	62,2 KB
R1-162549.zip	2016/04/01 10:56	105 KB
R1-162550.zip	2016/04/01 10:56	95,5 KB
R1-162551.zip	2016/04/01 8:44	75,2 KB
R1-162552.zip	2016/04/01 8:44	69,6 KB
R1-162553.zip	2016/04/01 11:29	71,8 KB
R1-162554.zip	2016/04/01 18:17	19 KB
R1-162555.zip	2016/04/01 18:17	27,5 KB
R1-162556.zip	2016/04/01 18:17	17,1 KB
R1-162557.zip	2016/04/01 18:17	17,3 KB
R1-162558.zip	2016/04/01 18:17	13,2 KB
R1-162559.zip	2016/04/01 18:32	42,3 KB
R1-162560.zip	2016/04/01 18:32	45,8 KB
R1-162561.zip	2016/04/01 18:17	136,8 KB
R1-162562.zip	2016/04/01 18:17	42 KB
R1-162563.zip	2016/04/01 18:32	45,2 KB
R1-162564.zip	2016/04/01 18:17	37,5 KB
R1-162565.zip	2016/04/01 18:17	34,7 KB
R1-162566.zip	2016/04/01 18:17	34,7 KB
R1-162567.zip	2016/04/01 14:53	556,3 KB
R1-162568.zip	2016/04/01 14:53	1034,9 KB
R1-162569.zip	2016/04/01 9:03	68,4 KB
R1-162570.zip	2016/04/01 20:11	2371,2 KB
R1-162572.zip	2016/04/01 20:11	19 KB
R1-162573.zip	2016/04/01 20:11	182,3 KB
R1-162574.zip	2016/04/01 20:11	45,5 KB
R1-162575.zip	2016/04/02 6:13	72 KB
R1-162576.zip	2016/04/01 21:16	42,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162577.zip	2016/04/02 0:16	31,1 KB
R1-162578.zip	2016/04/02 0:16	29,6 KB
R1-162579.zip	2016/04/02 0:16	63,4 KB
R1-162580.zip	2016/04/02 2:11	1288,9 KB
R1-162581.zip	2016/04/02 2:10	89,9 KB
R1-162582.zip	2016/04/01 9:11	342,3 KB
R1-162583.zip	2016/04/01 23:04	570,4 KB
R1-162584.zip	2016/04/01 23:04	95,7 KB
R1-162585.zip	2016/04/02 0:58	75,5 KB
R1-162586.zip	2016/04/02 0:58	68,1 KB
R1-162587.zip	2016/04/02 0:58	53,1 KB
R1-162588.zip	2016/04/01 23:04	116,2 KB
R1-162589.zip	2016/04/01 23:04	42,4 KB
R1-162590.zip	2016/04/01 23:04	110,9 KB
R1-162591.zip	2016/04/01 23:17	133,5 KB
R1-162592.zip	2016/04/01 23:04	34,4 KB
R1-162593.zip	2016/04/01 23:04	272,6 KB
R1-162594.zip	2016/04/01 23:04	32,1 KB
R1-162595.zip	2016/04/01 23:17	289,9 KB
R1-162596.zip	2016/04/01 23:17	94,7 KB
R1-162597.zip	2016/04/01 23:17	298,4 KB
R1-162598.zip	2016/04/01 23:17	275,6 KB
R1-162599.zip	2016/04/01 23:17	29,9 KB
R1-162600.zip	2016/04/01 23:17	203,8 KB
R1-162601.zip	2016/04/01 23:17	75,6 KB
R1-162602.zip	2016/04/01 23:04	183,7 KB
R1-162603.zip	2016/04/01 23:04	60,1 KB
R1-162604.zip	2016/04/01 23:04	117 KB
R1-162605.zip	2016/04/01 23:04	142,3 KB
R1-162606.zip	2016/04/01 23:04	420,2 KB
R1-162607.zip	2016/04/01 23:04	303,7 KB
R1-162608.zip	2016/04/01 23:04	105,9 KB
R1-162609.zip	2016/04/01 23:17	92,2 KB
R1-162610.zip	2016/04/01 23:04	34,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162611.zip	2016/04/01 23:04	85,7 KB
R1-162612.zip	2016/04/01 23:04	66,8 KB
R1-162613.zip	2016/04/01 23:04	55,2 KB
R1-162614.zip	2016/04/01 23:04	25,6 KB
R1-162615.zip	2016/04/01 23:04	60,3 KB
R1-162616.zip	2016/04/01 23:04	38,8 KB
R1-162617.zip	2016/04/01 23:04	98,3 KB
R1-162618.zip	2016/04/01 23:04	146,8 KB
R1-162619.zip	2016/04/01 23:04	84,3 KB
R1-162620.zip	2016/04/01 23:04	25,9 KB
R1-162621.zip	2016/04/01 23:04	50,6 KB
R1-162622.zip	2016/04/01 23:04	41,4 KB
R1-162623.zip	2016/04/01 23:04	12,5 KB
R1-162624.zip	2016/04/01 23:04	41 KB
R1-162625.zip	2016/04/05 20:38	53 KB
R1-162626.zip	2016/04/06 4:19	69,2 KB
R1-162627.zip	2016/04/05 20:38	241,2 KB
R1-162628.zip	2016/04/05 20:38	478,3 KB
R1-162629.zip	2016/04/05 20:38	72,3 KB
R1-162630.zip	2016/04/05 20:38	48,5 KB
R1-162631.zip	2016/04/05 20:38	74,2 KB
R1-162632.zip	2016/04/05 20:38	42,1 KB
R1-162633.zip	2016/04/05 20:38	41 KB
R1-162634.zip	2016/04/05 20:38	53,6 KB
R1-162635.zip	2016/04/06 4:19	109,2 KB
R1-162636.zip	2016/04/05 20:44	267,1 KB
R1-162637.zip	2016/04/01 23:04	18,7 KB
R1-162638.zip	2016/04/01 23:04	31,4 KB
R1-162639.zip	2016/04/01 23:17	850,4 KB
R1-162640.zip	2016/04/01 23:18	863,4 KB
R1-162641.zip	2016/04/02 1:58	271,5 KB
R1-162642.zip	2016/04/01 23:18	89,5 KB
R1-162643.zip	2016/04/01 23:18	67 KB
R1-162644.zip	2016/04/01 23:04	240,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162645.zip	2016/04/02 0:25	85,4 KB
R1-162646.zip	2016/04/02 0:25	17,8 KB
R1-162647.zip	2016/04/02 0:25	52,2 KB
R1-162649.zip	2016/04/01 21:51	61,2 KB
R1-162650.zip	2016/04/01 21:51	610,6 KB
R1-162651.zip	2016/04/01 23:36	26,2 KB
R1-162652.zip	2016/04/01 7:49	47,6 KB
R1-162653.zip	2016/04/01 7:49	68,1 KB
R1-162654.zip	2016/04/01 7:49	32 KB
R1-162655.zip	2016/04/01 12:48	71,1 KB
R1-162656.zip	2016/04/01 12:48	64,9 KB
R1-162657.zip	2016/04/02 0:25	23,1 KB
R1-162658.zip	2016/04/02 0:25	57,1 KB
R1-162659.zip	2016/04/02 0:25	48,5 KB
R1-162660.zip	2016/04/02 0:25	50,6 KB
R1-162661.zip	2016/04/01 9:30	199,6 KB
R1-162662.zip	2016/04/02 3:34	175 KB
R1-162663.zip	2016/04/02 3:34	52,2 KB
R1-162664.zip	2016/04/02 3:34	51,3 KB
R1-162665.zip	2016/04/02 3:34	254,4 KB
R1-162666.zip	2016/04/02 3:34	53 KB
R1-162667.zip	2016/04/02 3:34	51,7 KB
R1-162668.zip	2016/04/02 0:25	104,5 KB
R1-162669.zip	2016/04/02 3:34	503,9 KB
R1-162670.zip	2016/04/02 1:01	70,6 KB
R1-162671.zip	2016/04/02 3:34	281,8 KB
R1-162672.zip	2016/04/02 1:01	377,3 KB
R1-162673.zip	2016/04/02 3:34	72,5 KB
R1-162674.zip	2016/04/01 17:47	23,2 KB
R1-162675.zip	2016/04/01 21:43	92,8 KB
R1-162676.zip	2016/04/02 2:05	92,4 KB
R1-162677.zip	2016/04/01 23:42	261,3 KB
R1-162678.zip	2016/04/01 18:04	50,7 KB
R1-162679.zip	2016/04/02 3:35	309,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162680.zip	2016/04/02 3:35	458,6 KB
R1-162681.zip	2016/04/01 9:55	90,7 KB
R1-162682.zip	2016/04/02 3:35	1079,7 KB
R1-162683.zip	2016/04/02 3:35	159,1 KB
R1-162684.zip	2016/04/01 7:49	269,3 KB
R1-162685.zip	2016/04/01 23:36	257 KB
R1-162686.zip	2016/04/01 23:36	90,9 KB
R1-162687.zip	2016/04/01 16:09	49 KB
R1-162688.zip	2016/04/01 12:48	52,6 KB
R1-162689.zip	2016/04/01 21:51	1928,7 KB
R1-162690.zip	2016/04/01 23:37	129,8 KB
R1-162691.zip	2016/04/01 21:51	271,4 KB
R1-162693.zip	2016/04/01 21:51	381,5 KB
R1-162694.zip	2016/04/01 23:37	280,1 KB
R1-162695.zip	2016/04/01 7:49	38,8 KB
R1-162696.zip	2016/04/01 12:48	133,8 KB
R1-162697.zip	2016/04/01 12:48	805,1 KB
R1-162698.zip	2016/04/02 0:25	50,3 KB
R1-162699.zip	2016/04/02 3:35	69,2 KB
R1-162700.zip	2016/04/02 0:00	879,7 KB
R1-162702.zip	2016/04/01 23:17	24,5 KB
R1-162703.zip	2016/04/01 9:26	154,9 KB
R1-162704.zip	2016/04/01 9:27	113,8 KB
R1-162705.zip	2016/04/01 9:27	114,1 KB
R1-162706.zip	2016/04/01 9:27	161,3 KB
R1-162707.zip	2016/04/01 9:27	128,2 KB
R1-162708.zip	2016/04/01 9:27	82 KB
R1-162709.zip	2016/04/01 9:27	82,7 KB
R1-162710.zip	2016/04/05 12:53	255,5 KB
R1-162711.zip	2016/04/05 12:53	227,5 KB
R1-162712.zip	2016/04/05 12:53	113 KB
R1-162713.zip	2016/04/05 12:53	72,7 KB
R1-162714.zip	2016/04/05 12:53	28,2 KB
R1-162715.zip	2016/04/05 12:53	19,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162716.zip	2016/04/01 19:59	227,4 KB
R1-162717.zip	2016/04/01 19:59	72,5 KB
R1-162718.zip	2016/04/01 19:43	373,2 KB
R1-162719.zip	2016/04/01 19:30	252,5 KB
R1-162720.zip	2016/04/01 19:43	389,3 KB
R1-162721.zip	2016/04/01 19:43	248,9 KB
R1-162722.zip	2016/04/01 20:08	110,4 KB
R1-162723.zip	2016/04/01 19:43	24 KB
R1-162724.zip	2016/04/01 20:09	220,9 KB
R1-162726.zip	2016/04/02 6:14	199,1 KB
R1-162727.zip	2016/04/02 0:05	33,8 KB
R1-162728.zip	2016/04/02 0:05	133,5 KB
R1-162729.zip	2016/04/02 0:05	36,9 KB
R1-162730.zip	2016/04/01 22:37	734,5 KB
R1-162731.zip	2016/04/01 22:37	114,1 KB
R1-162732.zip	2016/04/01 22:37	42,8 KB
R1-162733.zip	2016/04/01 22:37	77,7 KB
R1-162734.zip	2016/04/01 22:37	82,9 KB
R1-162735.zip	2016/04/01 22:37	81,4 KB
R1-162736.zip	2016/04/01 22:37	49,1 KB
R1-162737.zip	2016/04/01 22:37	48 KB
R1-162738.zip	2016/04/01 22:37	60 KB
R1-162739.zip	2016/04/01 22:37	55,1 KB
R1-162741.zip	2016/04/01 22:37	53,5 KB
R1-162742.zip	2016/04/01 22:37	86,4 KB
R1-162743.zip	2016/04/01 22:37	194,4 KB
R1-162744.zip	2016/04/01 22:37	128 KB
R1-162745.zip	2016/04/01 11:51	144,4 KB
R1-162746.zip	2016/04/01 11:51	83,9 KB
R1-162747.zip	2016/04/01 11:51	14 KB
R1-162748.zip	2016/04/01 11:51	52,2 KB
R1-162749.zip	2016/04/01 11:51	97,7 KB
R1-162750.zip	2016/04/01 10:56	271,9 KB
R1-162751.zip	2016/04/02 0:05	82,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162752.zip	2016/04/01 4:59	365 KB
R1-162753.zip	2016/04/01 5:00	381,1 KB
R1-162754.zip	2016/04/01 11:24	53,8 KB
R1-162755.zip	2016/04/01 14:57	160,7 KB
R1-162756.zip	2016/04/01 19:54	71,4 KB
R1-162757.zip	2016/04/05 22:55	33,4 KB
R1-162758.zip	2016/04/05 22:55	49,9 KB
R1-162759.zip	2016/04/05 22:55	75,4 KB
R1-162760.zip	2016/04/05 22:55	54,4 KB
R1-162761.zip	2016/04/05 22:55	45,7 KB
R1-162762.zip	2016/04/05 22:55	89,1 KB
R1-162763.zip	2016/04/05 22:55	44,9 KB
R1-162764.zip	2016/04/05 22:55	34,9 KB
R1-162765.zip	2016/04/05 22:55	49,6 KB
R1-162766.zip	2016/04/01 17:08	30,6 KB
R1-162767.zip	2016/04/01 17:08	36,3 KB
R1-162768.zip	2016/04/01 17:08	45,8 KB
R1-162769.zip	2016/04/01 19:07	17,9 KB
R1-162770.zip	2016/04/01 19:07	9,5 KB
R1-162771.zip	2016/04/01 19:07	18 KB
R1-162772.zip	2016/04/06 5:59	39,3 KB
R1-162773.zip	2016/04/06 5:59	73,5 KB
R1-162774.zip	2016/04/06 5:59	72,1 KB
R1-162775.zip	2016/04/06 5:59	87,2 KB
R1-162776.zip	2016/04/06 5:59	56,4 KB
R1-162777.zip	2016/04/06 5:59	234,9 KB
R1-162778.zip	2016/04/06 5:59	69,2 KB
R1-162779.zip	2016/04/06 5:59	106,2 KB
R1-162780.zip	2016/04/06 5:59	97,4 KB
R1-162781.zip	2016/04/06 5:59	47,6 KB
R1-162782.zip	2016/04/06 5:59	85,1 KB
R1-162783.zip	2016/04/01 15:18	19,8 KB
R1-162784.zip	2016/04/01 15:18	102,6 KB
R1-162785.zip	2016/04/01 15:18	21,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162786.zip	2016/04/01 15:18	20,2 KB
R1-162787.zip	2016/04/01 15:18	36,5 KB
R1-162788.zip	2016/04/01 15:18	22 KB
R1-162789.zip	2016/04/01 15:18	55,8 KB
R1-162790.zip	2016/04/01 15:18	113,6 KB
R1-162791.zip	2016/04/02 3:19	38,5 KB
R1-162792.zip	2016/04/02 3:19	55,9 KB
R1-162793.zip	2016/04/02 3:19	28,9 KB
R1-162794.zip	2016/04/02 3:19	51,4 KB
R1-162795.zip	2016/04/02 3:19	24 KB
R1-162796.zip	2016/04/02 3:19	58,1 KB
R1-162797.zip	2016/04/02 3:19	163,9 KB
R1-162798.zip	2016/04/02 3:19	27,9 KB
R1-162799.zip	2016/04/01 10:54	236,3 KB
R1-162800.zip	2016/04/01 10:54	70 KB
R1-162801.zip	2016/04/01 10:54	104,9 KB
R1-162802.zip	2016/04/01 10:54	134 KB
R1-162803.zip	2016/04/01 10:54	163,5 KB
R1-162804.zip	2016/04/01 10:54	157,8 KB
R1-162805.zip	2016/04/01 11:22	54,4 KB
R1-162806.zip	2016/04/01 21:52	445,8 KB
R1-162807.zip	2016/04/01 21:52	49,5 KB
R1-162808.zip	2016/04/01 21:52	32,2 KB
R1-162809.zip	2016/04/01 21:52	72,6 KB
R1-162810.zip	2016/04/01 21:52	167,7 KB
R1-162811.zip	2016/04/01 21:52	39,7 KB
R1-162812.zip	2016/04/01 21:52	75,6 KB
R1-162813.zip	2016/04/01 21:52	88,8 KB
R1-162814.zip	2016/04/01 16:36	48,8 KB
R1-162815.zip	2016/04/01 16:36	207,1 KB
R1-162816.zip	2016/04/01 18:47	62,8 KB
R1-162817.zip	2016/04/01 18:47	235,1 KB
R1-162818.zip	2016/04/01 18:47	63,1 KB
R1-162819.zip	2016/04/01 18:47	51,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162820.zip	2016/04/01 16:36	112,9 KB
R1-162821.zip	2016/04/01 18:47	45,2 KB
R1-162822.zip	2016/04/01 18:47	52 KB
R1-162823.zip	2016/04/01 16:36	214 KB
R1-162824.zip	2016/04/01 16:36	14,4 KB
R1-162825.zip	2016/04/01 16:36	205 KB
R1-162826.zip	2016/04/01 16:36	387,7 KB
R1-162827.zip	2016/04/01 16:36	89 KB
R1-162828.zip	2016/04/01 16:36	78,8 KB
R1-162829.zip	2016/04/01 16:36	177 KB
R1-162830.zip	2016/04/01 16:36	230,9 KB
R1-162831.zip	2016/04/01 16:36	109,6 KB
R1-162832.zip	2016/04/01 16:36	78,7 KB
R1-162833.zip	2016/04/01 16:36	250,5 KB
R1-162834.zip	2016/04/01 16:36	199,8 KB
R1-162835.zip	2016/04/06 4:53	106,5 KB
R1-162836.zip	2016/04/06 5:43	66,7 KB
R1-162837.zip	2016/04/06 4:52	61,2 KB
R1-162838.zip	2016/04/02 3:25	88,5 KB
R1-162839.zip	2016/04/02 3:25	68,1 KB
R1-162840.zip	2016/04/02 3:26	71,7 KB
R1-162841.zip	2016/04/02 3:27	50,2 KB
R1-162842.zip	2016/04/02 3:28	1017,6 KB
R1-162843.zip	2016/04/02 3:29	440,2 KB
R1-162844.zip	2016/04/02 3:30	314,9 KB
R1-162845.zip	2016/04/02 3:30	211,9 KB
R1-162846.zip	2016/04/02 3:31	56,1 KB
R1-162847.zip	2016/04/02 4:52	31,7 KB
R1-162848.zip	2016/04/01 7:51	31 KB
R1-162849.zip	2016/04/01 7:51	23,9 KB
R1-162850.zip	2016/04/01 7:51	42,3 KB
R1-162851.zip	2016/04/02 4:52	100,9 KB
R1-162852.zip	2016/04/02 5:48	50,3 KB
R1-162853.zip	2016/04/02 4:52	61,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-162855.zip	2016/04/02 4:52	311,3 KB
R1-162856.zip	2016/04/02 4:52	30 KB
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R1-162859.zip	2016/04/02 9:45	48 KB
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R1-162862.zip	2016/04/02 9:45	427,7 KB
R1-162863.zip	2016/04/02 9:45	139,8 KB
R1-162864.zip	2016/04/02 9:44	182,1 KB
R1-162865.zip	2016/04/02 9:44	35,1 KB
R1-162866.zip	2016/04/02 9:44	86,8 KB
R1-162867.zip	2016/04/02 9:44	92,8 KB
R1-162868.zip	2016/04/02 9:44	37,5 KB
R1-162869.zip	2016/04/02 9:44	42,5 KB
R1-162870.zip	2016/04/02 9:44	173,1 KB
R1-162871.zip	2016/04/02 9:44	75,8 KB
R1-162872.zip	2016/04/02 4:58	7816,7 KB
R1-162873.zip	2016/04/02 5:59	23,3 KB
R1-162874.zip	2016/04/02 5:49	51,3 KB
R1-162875.zip	2016/04/02 5:49	103,1 KB
R1-162876.zip	2016/04/02 5:49	27,7 KB
R1-162877.zip	2016/04/02 5:49	23,1 KB
R1-162878.zip	2016/04/02 5:49	29,1 KB
R1-162879.zip	2016/04/01 18:55	37,5 KB
R1-162880.zip	2016/04/01 23:48	551,5 KB
R1-162881.zip	2016/04/01 18:55	38 KB
R1-162882.zip	2016/04/01 19:34	36,2 KB
R1-162883.zip	2016/04/01 19:34	75,2 KB
R1-162884.zip	2016/04/01 19:34	32,1 KB
R1-162885.zip	2016/04/01 19:34	264 KB
R1-162886.zip	2016/04/01 19:34	23,5 KB
R1-162887.zip	2016/04/01 19:34	246,8 KB
R1-162888.zip	2016/04/01 19:34	50,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-162891.zip	2016/04/01 19:34	33,8 KB
R1-162892.zip	2016/04/01 19:34	33,8 KB
R1-162893.zip	2016/04/01 19:34	159,6 KB
R1-162894.zip	2016/04/01 19:34	75,5 KB
R1-162895.zip	2016/04/01 19:34	287,7 KB
R1-162896.zip	2016/04/01 19:34	47,6 KB
R1-162897.zip	2016/04/01 19:34	326,3 KB
R1-162898.zip	2016/04/01 19:34	85,3 KB
R1-162899.zip	2016/04/01 19:34	63,8 KB
R1-162900.zip	2016/04/01 19:34	32,8 KB
R1-162901.zip	2016/04/01 19:34	73,2 KB
R1-162902.zip	2016/04/05 12:01	33,1 KB
R1-162903.zip	2016/04/05 12:01	40,1 KB
R1-162904.zip	2016/04/05 12:01	36,8 KB
R1-162905.zip	2016/04/05 12:01	27,1 KB
R1-162906.zip	2016/04/05 12:01	144,6 KB
R1-162907.zip	2016/04/05 12:01	34,4 KB
R1-162908.zip	2016/04/05 12:01	30,2 KB
R1-162909.zip	2016/04/05 12:01	27,6 KB
R1-162910.zip	2016/04/01 15:30	52,7 KB
R1-162911.zip	2016/04/01 15:30	48,5 KB
R1-162912.zip	2016/04/01 15:30	48,4 KB
R1-162913.zip	2016/04/01 15:30	51 KB
R1-162914.zip	2016/04/01 23:14	66,6 KB
R1-162915.zip	2016/04/01 23:14	64,7 KB
R1-162916.zip	2016/04/01 23:14	33,4 KB
R1-162917.zip	2016/04/01 23:14	33,4 KB
R1-162918.zip	2016/04/01 23:14	91 KB
R1-162919.zip	2016/04/01 23:14	813,4 KB
R1-162920.zip	2016/04/01 23:14	261,9 KB
R1-162921.zip	2016/04/06 5:59	50,3 KB
R1-162922.zip	2016/04/01 21:56	53,8 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-162924.zip	2016/04/01 22:00	160,1 KB
R1-162925.zip	2016/04/01 22:02	388,6 KB
R1-162926.zip	2016/04/01 22:03	112,7 KB
R1-162927.zip	2016/04/01 22:03	187,1 KB
R1-162928.zip	2016/04/01 22:03	153,6 KB
R1-162929.zip	2016/04/02 1:59	351,4 KB
R1-162930.zip	2016/04/02 5:25	1807,5 KB
R1-162931.zip	2016/04/02 2:00	385,8 KB
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R1-162933.zip	2016/04/02 6:19	722,1 KB
R1-162934.zip	2016/04/02 6:14	153,1 KB
R1-162935.zip	2016/04/02 6:14	127,1 KB
R1-162936.zip	2016/04/02 0:25	149,3 KB
R1-162937.zip	2016/04/02 0:25	49,3 KB
R1-162938.zip	2016/04/02 0:25	80,5 KB
R1-162939.zip	2016/04/02 0:25	1178,2 KB
R1-162940.zip	2016/04/02 0:25	110,7 KB
R1-162941.zip	2016/04/02 0:25	200,9 KB
R1-162942.zip	2016/04/02 0:25	46,2 KB
R1-162943.zip	2016/04/02 0:25	144,3 KB
R1-162944.zip	2016/04/02 0:25	515 KB
R1-162945.zip	2016/04/02 0:25	76,3 KB
R1-162946.zip	2016/04/02 0:25	93,7 KB
R1-162947.zip	2016/04/02 0:25	222,7 KB
R1-162948.zip	2016/04/02 1:17	64,4 KB
R1-162949.zip	2016/04/02 1:18	540,8 KB
R1-162950.zip	2016/04/02 1:18	44,3 KB
R1-162951.zip	2016/04/02 1:17	83 KB
R1-162952.zip	2016/04/02 1:17	303,8 KB
R1-162953.zip	2016/04/02 1:17	149,2 KB
R1-162954.zip	2016/04/02 1:18	25,9 KB
R1-162955.zip	2016/04/02 1:17	276,2 KB
R1-162956.zip	2016/04/02 1:18	923,4 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-162957.zip	2016/04/02 1:18	28,3 KB
R1-162958.zip	2016/04/02 1:18	44,3 KB
R1-162959.zip	2016/04/02 1:18	34,4 KB
R1-162960.zip	2016/04/02 1:18	27,2 KB
R1-162961.zip	2016/04/01 21:12	20,1 KB
R1-162962.zip	2016/04/01 21:12	29,1 KB
R1-162963.zip	2016/04/01 21:12	59,9 KB
R1-162964.zip	2016/04/01 21:12	30,9 KB
R1-162965.zip	2016/04/01 21:12	75 KB
R1-162966.zip	2016/04/01 21:12	62 KB
R1-162967.zip	2016/04/02 3:12	69,4 KB
R1-162968.zip	2016/04/02 3:12	94,2 KB
R1-162969.zip	2016/04/02 3:12	68,8 KB
R1-162970.zip	2016/04/02 3:12	46,2 KB
R1-162971.zip	2016/04/02 3:12	131,9 KB
R1-162972.zip	2016/04/06 5:51	59,6 KB
R1-162973.zip	2016/04/06 5:51	56,8 KB
R1-162974.zip	2016/04/06 5:51	83,2 KB
R1-162975.zip	2016/04/06 5:51	52,8 KB
R1-162976.zip	2016/04/06 5:52	84,7 KB
R1-162977.zip	2016/04/06 5:51	64,5 KB
R1-162978.zip	2016/04/06 5:51	59,6 KB
R1-162980.zip	2016/04/06 5:51	53,9 KB
R1-162981.zip	2016/04/06 5:51	52,6 KB
R1-162982.zip	2016/04/01 21:28	88,1 KB
R1-162983.zip	2016/04/05 9:39	80,9 KB
R1-162984.zip	2016/04/05 9:39	50,5 KB
R1-162985.zip	2016/04/01 8:30	167,7 KB
R1-162986.zip	2016/04/01 8:30	212,7 KB
R1-162987.zip	2016/04/01 8:30	38 KB
R1-162988.zip	2016/04/01 8:49	38,8 KB
R1-162989.zip	2016/04/01 8:30	692,3 KB
R1-162990.zip	2016/04/01 8:30	738,3 KB
R1-162991.zip	2016/04/01 8:30	611,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-162993.zip	2016/04/01 8:30	20,6 KB
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R1-162996.zip	2016/04/02 0:49	64 KB
R1-162997.zip	2016/04/02 0:49	58 KB
R1-162998.zip	2016/04/02 0:49	82 KB
R1-162999.zip	2016/04/02 0:49	109 KB
R1-163000.zip	2016/04/02 0:49	51,4 KB
R1-163001.zip	2016/04/02 0:55	28,4 KB
R1-163002.zip	2016/04/02 0:55	24,7 KB
R1-163003.zip	2016/04/02 2:32	140,1 KB
R1-163004.zip	2016/04/02 2:32	31,9 KB
R1-163005.zip	2016/04/02 2:32	188,3 KB
R1-163006.zip	2016/04/02 2:32	24,9 KB
R1-163007.zip	2016/04/02 2:32	163,3 KB
R1-163008.zip	2016/04/02 2:32	46,2 KB
R1-163009.zip	2016/04/06 5:56	78,8 KB
R1-163010.zip	2016/04/06 5:56	81,5 KB
R1-163011.zip	2016/04/06 5:56	81,3 KB
R1-163012.zip	2016/04/06 5:56	215,7 KB
R1-163013.zip	2016/04/06 5:55	676,5 KB
R1-163015.zip	2016/04/06 5:55	44,7 KB
R1-163016.zip	2016/04/06 5:55	258 KB
R1-163017.zip	2016/04/06 5:55	138,7 KB
R1-163018.zip	2016/04/06 5:55	143,9 KB
R1-163019.zip	2016/04/02 0:55	193,6 KB
R1-163020.zip	2016/04/02 0:55	29,2 KB
R1-163021.zip	2016/04/02 0:55	30,8 KB
R1-163022.zip	2016/04/02 0:55	141,3 KB
R1-163023.zip	2016/04/02 0:55	29,8 KB
R1-163024.zip	2016/04/02 0:55	223,2 KB
R1-163025.zip	2016/04/02 0:55	68,6 KB
R1-163026.zip	2016/04/02 0:55	29,6 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163031.zip	2016/04/02 1:06	55,3 KB
R1-163032.zip	2016/04/02 1:06	141,4 KB
R1-163033.zip	2016/04/02 1:06	14,9 KB
R1-163034.zip	2016/04/02 1:06	32,4 KB
R1-163035.zip	2016/04/02 1:06	104,9 KB
R1-163036.zip	2016/04/02 1:06	20,9 KB
R1-163037.zip	2016/04/02 1:06	24,9 KB
R1-163038.zip	2016/04/02 1:15	129,6 KB
R1-163039.zip	2016/04/02 1:15	88,8 KB
R1-163040.zip	2016/04/02 1:15	50 KB
R1-163041.zip	2016/04/02 1:15	110,8 KB
R1-163042.zip	2016/04/02 1:15	21,2 KB
R1-163043.zip	2016/04/02 1:15	47,6 KB
R1-163044.zip	2016/04/02 1:15	22,7 KB
R1-163045.zip	2016/04/02 1:26	35,6 KB
R1-163046.zip	2016/04/02 1:26	78,8 KB
R1-163047.zip	2016/04/02 1:26	35,7 KB
R1-163048.zip	2016/04/02 1:26	224,6 KB
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R1-163050.zip	2016/04/02 2:16	79,5 KB
R1-163051.zip	2016/04/02 2:16	115,5 KB
R1-163052.zip	2016/04/02 2:16	78,6 KB
R1-163053.zip	2016/04/02 2:16	78,6 KB
R1-163054.zip	2016/04/02 3:12	17,6 KB
R1-163055.zip	2016/04/02 2:16	80,7 KB
R1-163056.zip	2016/04/02 1:35	32,6 KB
R1-163057.zip	2016/04/02 1:35	457,8 KB
R1-163058.zip	2016/04/02 1:35	55,2 KB
R1-163059.zip	2016/04/02 2:38	103,2 KB
R1-163060.zip	2016/04/02 1:44	31,4 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163064.zip	2016/04/02 1:55	23 KB
R1-163065.zip	2016/04/02 2:05	44 KB
R1-163066.zip	2016/04/02 2:05	1174 KB
R1-163067.zip	2016/04/02 2:05	844,1 KB
R1-163068.zip	2016/04/02 2:05	428,1 KB
R1-163069.zip	2016/04/02 2:05	482 KB
R1-163070.zip	2016/04/02 2:05	447,8 KB
R1-163071.zip	2016/04/02 2:05	59,7 KB
R1-163072.zip	2016/04/02 2:05	779,1 KB
R1-163073.zip	2016/04/01 8:33	96,8 KB
R1-163074.zip	2016/04/01 8:33	49,5 KB
R1-163075.zip	2016/04/02 8:40	60,9 KB
R1-163076.zip	2016/04/02 8:40	74,9 KB
R1-163077.zip	2016/04/02 2:04	191,2 KB
R1-163078.zip	2016/04/02 2:05	454,2 KB
R1-163079.zip	2016/04/02 5:58	60,2 KB
R1-163080.zip	2016/04/02 5:58	45,8 KB
R1-163081.zip	2016/04/02 5:58	42,6 KB
R1-163082.zip	2016/04/02 6:01	79,3 KB
R1-163083.zip	2016/04/02 5:58	68,6 KB
R1-163084.zip	2016/04/02 5:58	94,6 KB
R1-163085.zip	2016/04/02 5:53	19,3 KB
R1-163086.zip	2016/04/02 5:53	178,4 KB
R1-163087.zip	2016/04/02 5:58	87,4 KB
R1-163088.zip	2016/04/02 5:58	169,2 KB
R1-163089.zip	2016/04/02 2:57	96,5 KB
R1-163090.zip	2016/04/02 2:57	45,9 KB
R1-163091.zip	2016/04/02 6:07	63,6 KB
R1-163092.zip	2016/04/02 3:48	38,4 KB
R1-163093.zip	2016/04/02 2:01	49,4 KB
R1-163094.zip	2016/04/02 0:34	189,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163098.zip	2016/04/02 5:58	303,6 KB
R1-163099.zip	2016/04/02 5:58	55,5 KB
R1-163101.zip	2016/04/02 3:38	53,4 KB
R1-163102.zip	2016/04/01 18:50	144,5 KB
R1-163103.zip	2016/04/02 2:15	40,7 KB
R1-163104.zip	2016/04/02 2:15	664,7 KB
R1-163105.zip	2016/04/01 22:47	68,5 KB
R1-163106.zip	2016/04/02 2:15	185,2 KB
R1-163107.zip	2016/04/01 22:47	50,2 KB
R1-163108.zip	2016/04/02 2:15	37,3 KB
R1-163109.zip	2016/04/02 2:15	31,7 KB
R1-163110.zip	2016/04/02 2:15	2297,4 KB
R1-163111.zip	2016/04/02 2:16	151,7 KB
R1-163112.zip	2016/04/01 22:47	181,6 KB
R1-163113.zip	2016/04/01 22:47	621,9 KB
R1-163114.zip	2016/04/02 2:16	422,8 KB
R1-163115.zip	2016/04/02 6:14	1065 KB
R1-163116.zip	2016/04/01 18:50	97,4 KB
R1-163117.zip	2016/04/01 18:50	59,1 KB
R1-163118.zip	2016/04/01 14:47	33,3 KB
R1-163119.zip	2016/04/01 18:50	100,3 KB
R1-163120.zip	2016/04/01 14:47	107,8 KB
R1-163121.zip	2016/04/01 14:47	720,3 KB
R1-163122.zip	2016/04/02 8:40	31,9 KB
R1-163123.zip	2016/04/01 8:47	260,8 KB
R1-163124.zip	2016/04/01 15:09	58 KB
R1-163125.zip	2016/04/01 8:54	32,8 KB
R1-163126.zip	2016/04/01 8:54	75,2 KB
R1-163127.zip	2016/04/01 8:54	24,2 KB
R1-163128.zip	2016/04/01 8:54	315,6 KB
R1-163129.zip	2016/04/02 0:22	47,7 KB

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R1-163132.zip	2016/04/01 8:54	19 KB
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R1-163134.zip	2016/04/02 2:07	72,2 KB
R1-163135.zip	2016/04/03 23:08	226,1 KB
R1-163136.zip	2016/04/01 16:11	76,1 KB
R1-163137.zip	2016/04/01 14:47	58,6 KB
R1-163138.zip	2016/04/02 5:46	63,5 KB
R1-163139.zip	2016/04/02 5:46	46,1 KB
R1-163140.zip	2016/04/02 5:46	91,9 KB
R1-163141.zip	2016/04/02 5:46	110,9 KB
R1-163142.zip	2016/04/02 5:46	119,5 KB
R1-163143.zip	2016/04/02 5:46	64,1 KB
R1-163144.zip	2016/04/02 5:46	164,5 KB
R1-163145.zip	2016/04/02 5:46	127,1 KB
R1-163146.zip	2016/04/02 5:46	177,2 KB
R1-163147.zip	2016/04/02 5:46	152,7 KB
R1-163148.zip	2016/04/02 5:47	89,4 KB
R1-163149.zip	2016/04/02 5:47	96,3 KB
R1-163150.zip	2016/04/02 5:47	53,5 KB
R1-163151.zip	2016/04/02 5:47	41,3 KB
R1-163152.zip	2016/04/02 5:47	115,1 KB
R1-163153.zip	2016/04/02 5:47	45,4 KB
R1-163154.zip	2016/04/01 14:48	71,3 KB
R1-163155.zip	2016/04/01 14:47	112,9 KB
R1-163156.zip	2016/04/01 12:37	68,1 KB
R1-163157.zip	2016/04/01 9:20	47,9 KB
R1-163158.zip	2016/04/01 14:47	90,8 KB
R1-163159.zip	2016/04/01 12:41	206,1 KB
R1-163160.zip	2016/04/01 9:19	213,9 KB
R1-163161.zip	2016/04/01 11:35	64,3 KB
R1-163162.zip	2016/04/02 6:14	56,2 KB
R1-163163.zip	2016/04/02 6:14	185 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163165.zip	2016/04/01 15:03	61,6 KB
R1-163166.zip	2016/04/01 9:45	39,7 KB
R1-163167.zip	2016/04/05 10:36	41,2 KB
R1-163168.zip	2016/04/05 10:36	47,9 KB
R1-163169.zip	2016/04/02 2:20	78,8 KB
R1-163170.zip	2016/04/02 2:20	349,7 KB
R1-163171.zip	2016/04/01 22:45	104,1 KB
R1-163172.zip	2016/04/01 22:45	228,7 KB
R1-163173.zip	2016/04/01 22:45	100,1 KB
R1-163174.zip	2016/04/01 22:45	100,2 KB
R1-163175.zip	2016/04/01 22:45	112,5 KB
R1-163176.zip	2016/04/02 2:13	98,7 KB
R1-163177.zip	2016/04/02 2:13	45,6 KB
R1-163178.zip	2016/04/02 2:13	50,5 KB
R1-163179.zip	2016/04/02 2:13	44,3 KB
R1-163180.zip	2016/04/02 2:13	92,2 KB
R1-163181.zip	2016/04/02 2:13	142,9 KB
R1-163182.zip	2016/04/02 2:13	314,1 KB
R1-163183.zip	2016/04/02 2:13	51,7 KB
R1-163184.zip	2016/04/02 2:13	42,2 KB
R1-163185.zip	2016/04/02 6:14	195 KB
R1-163186.zip	2016/04/02 6:14	122,9 KB
R1-163187.zip	2016/04/02 6:14	290,3 KB
R1-163188.zip	2016/04/02 6:15	163,2 KB
R1-163189.zip	2016/04/02 6:15	168 KB
R1-163190.zip	2016/04/01 12:38	928 KB
R1-163191.zip	2016/04/01 9:40	30,6 KB
R1-163192.zip	2016/04/01 21:30	1224,4 KB
R1-163193.zip	2016/04/01 21:28	1177,6 KB
R1-163194.zip	2016/04/01 21:29	2368,5 KB
R1-163195.zip	2016/04/01 21:29	44,8 KB
R1-163196.zip	2016/04/01 21:29	45,2 KB
R1-163197.zip	2016/04/01 21:32	15,4 KB

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IPR2024-01121

	sort by name/desc	sort by date/desc	sort by size/desc
R1-163198.zip		2016/04/01 21:32	15,4 KB
R1-163199.zip		2016/04/02 4:31	12,2 KB
R1-163200.zip		2016/04/02 4:31	76,1 KB
R1-163201.zip		2016/04/02 4:31	188,2 KB
R1-163202.zip		2016/04/02 4:32	91,9 KB
R1-163203.zip		2016/04/02 4:32	79,2 KB
R1-163204.zip		2016/04/01 11:08	22,1 KB
R1-163205.zip		2016/04/01 11:08	35,8 KB
R1-163206.zip		2016/04/01 11:08	54,8 KB
R1-163207.zip		2016/04/01 11:09	153,7 KB
R1-163208.zip		2016/04/01 11:09	22,9 KB
R1-163209.zip		2016/04/01 11:09	21,4 KB
R1-163210.zip		2016/04/02 6:15	174,9 KB
R1-163211.zip		2016/04/01 9:50	46 KB
R1-163212.zip		2016/04/02 5:30	45,6 KB
R1-163213.zip		2016/04/05 10:39	41,5 KB
R1-163214.zip		2016/04/05 10:39	23,9 KB
R1-163215.zip		2016/04/01 21:08	25,4 KB
R1-163216.zip		2016/04/01 21:08	22,8 KB
R1-163217.zip		2016/04/01 21:08	26,2 KB
R1-163218.zip		2016/04/01 21:08	26,2 KB
R1-163219.zip		2016/04/01 21:08	429,1 KB
R1-163220.zip		2016/04/01 21:08	49 KB
R1-163221.zip		2016/04/01 21:08	65,1 KB
R1-163222.zip		2016/04/01 21:08	45,7 KB
R1-163223.zip		2016/04/01 21:08	108,7 KB
R1-163224.zip		2016/04/01 21:09	217,9 KB
R1-163225.zip		2016/04/01 21:09	21,6 KB
R1-163226.zip		2016/04/01 21:09	41,6 KB
R1-163227.zip		2016/04/01 21:09	411,1 KB
R1-163228.zip		2016/04/01 21:09	16,3 KB
R1-163229.zip		2016/04/01 21:09	132,6 KB
R1-163230.zip		2016/04/01 21:09	40,2 KB
R1-163231.zip		2016/04/01 21:59	46 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163234.zip	2016/04/01 21:09	21,2 KB
R1-163235.zip	2016/04/01 21:09	22 KB
R1-163236.zip	2016/04/01 21:09	53,1 KB
R1-163237.zip	2016/04/01 21:09	133,8 KB
R1-163238.zip	2016/04/01 21:09	105,7 KB
R1-163239.zip	2016/04/01 21:09	628,3 KB
R1-163240.zip	2016/04/01 21:09	1298,4 KB
R1-163241.zip	2016/04/01 21:09	198,4 KB
R1-163242.zip	2016/04/01 21:09	684,7 KB
R1-163243.zip	2016/04/01 21:09	109,6 KB
R1-163244.zip	2016/04/01 21:09	55 KB
R1-163245.zip	2016/04/01 21:09	44 KB
R1-163246.zip	2016/04/01 21:09	152,3 KB
R1-163247.zip	2016/04/01 21:09	28,4 KB
R1-163248.zip	2016/04/01 21:09	106,2 KB
R1-163249.zip	2016/04/01 21:46	29,5 KB
R1-163250.zip	2016/04/01 21:09	286,6 KB
R1-163251.zip	2016/04/01 21:09	190,6 KB
R1-163252.zip	2016/04/01 21:10	604,2 KB
R1-163253.zip	2016/04/01 21:10	74 KB
R1-163254.zip	2016/04/01 21:10	3775,9 KB
R1-163255.zip	2016/04/01 21:10	28,3 KB
R1-163256.zip	2016/04/01 21:10	48 KB
R1-163257.zip	2016/04/01 21:10	1538,4 KB
R1-163258.zip	2016/04/01 21:10	101,5 KB
R1-163259.zip	2016/04/01 22:58	312,1 KB
R1-163260.zip	2016/04/06 4:44	63,1 KB
R1-163261.zip	2016/04/06 4:44	82 KB
R1-163262.zip	2016/04/06 4:44	60,8 KB
R1-163263.zip	2016/04/06 4:44	70,9 KB
R1-163264.zip	2016/04/01 20:38	1213,5 KB
R1-163265.zip	2016/04/01 20:39	2257,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163267.zip	2016/04/01 20:39	82,2 KB
R1-163268.zip	2016/04/02 3:38	18,8 KB
R1-163269.zip	2016/04/01 18:17	160,5 KB
R1-163270.zip	2016/04/01 18:17	281,8 KB
R1-163271.zip	2016/04/05 17:17	73,4 KB
R1-163272.zip	2016/04/05 17:17	36,4 KB
R1-163273.zip	2016/04/05 17:17	284,8 KB
R1-163274.zip	2016/04/01 19:34	36 KB
R1-163275.zip	2016/04/06 1:44	19,1 KB
R1-163276.zip	2016/04/06 1:44	20 KB
R1-163278.zip	2016/04/06 1:44	18,6 KB
R1-163279.zip	2016/04/06 1:44	18,8 KB
R1-163280.zip	2016/04/02 3:32	25,1 KB
R1-163281.zip	2016/04/02 3:32	23,7 KB
R1-163282.zip	2016/04/01 20:14	37,7 KB
R1-163283.zip	2016/04/02 3:32	57,7 KB
R1-163284.zip	2016/04/01 20:57	34,5 KB
R1-163285.zip	2016/04/02 6:03	24,5 KB
R1-163286.zip	2016/04/02 6:03	37,2 KB
R1-163287.zip	2016/04/02 6:03	20,6 KB
R1-163288.zip	2016/04/02 6:03	20,4 KB
R1-163289.zip	2016/04/02 6:03	22 KB
R1-163290.zip	2016/04/02 6:03	21,2 KB
R1-163291.zip	2016/04/02 6:03	19,3 KB
R1-163292.zip	2016/04/02 3:31	57,5 KB
R1-163293.zip	2016/04/02 3:31	36,9 KB
R1-163294.zip	2016/04/02 3:31	36,6 KB
R1-163295.zip	2016/04/02 3:31	123,7 KB
R1-163296.zip	2016/04/02 6:26	183,9 KB
R1-163297.zip	2016/04/02 7:34	147 KB
R1-163298.zip	2016/04/02 6:26	198,5 KB
R1-163299.zip	2016/04/01 20:32	326,3 KB
R1-163300.zip	2016/04/01 20:32	389,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163302.zip	2016/04/01 20:32	64,5 KB
R1-163303.zip	2016/04/01 20:32	116 KB
R1-163304.zip	2016/04/02 4:59	329,1 KB
R1-163305.zip	2016/04/02 4:59	81,2 KB
R1-163306.zip	2016/04/02 8:12	83,5 KB
R1-163307.zip	2016/04/02 4:59	32,8 KB
R1-163308.zip	2016/04/06 22:21	529,3 KB
R1-163309.zip	2016/04/06 22:21	166 KB
R1-163310.zip	2016/04/02 4:22	61,8 KB
R1-163311.zip	2016/04/02 5:31	22,1 KB
R1-163312.zip	2016/04/01 19:05	178,6 KB
R1-163313.zip	2016/04/01 17:51	655,9 KB
R1-163314.zip	2016/04/01 17:52	1239,6 KB
R1-163315.zip	2016/04/01 17:52	497,2 KB
R1-163316.zip	2016/04/01 17:52	172 KB
R1-163317.zip	2016/04/01 17:52	91,5 KB
R1-163318.zip	2016/04/01 17:52	344 KB
R1-163319.zip	2016/04/01 17:52	58,5 KB
R1-163320.zip	2016/04/01 17:52	83,9 KB
R1-163321.zip	2016/04/01 17:52	48,5 KB
R1-163322.zip	2016/04/01 17:52	71,1 KB
R1-163323.zip	2016/04/01 17:52	106,3 KB
R1-163324.zip	2016/04/01 17:52	69,2 KB
R1-163325.zip	2016/04/01 17:52	98 KB
R1-163326.zip	2016/04/01 17:52	86 KB
R1-163327.zip	2016/04/02 6:22	19,3 KB
R1-163328.zip	2016/04/02 5:58	19,5 KB
R1-163332.zip	2016/04/01 13:48	173,9 KB
R1-163333.zip	2016/04/05 15:22	67,6 KB
R1-163334.zip	2016/04/01 23:04	136,3 KB
R1-163335.zip	2016/04/01 23:04	101 KB
R1-163337.zip	2016/04/01 23:18	89 KB
R1-163338.zip	2016/04/02 0:58	54,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-163340.zip	2016/04/01 23:03	44,6 KB
R1-163341.zip	2016/04/06 4:19	52,4 KB
R1-163342.zip	2016/04/05 20:38	65,4 KB
R1-163343.zip	2016/04/05 20:38	37 KB
R1-163344.zip	2016/04/02 2:48	35,3 KB
R1-163345.zip	2016/04/02 2:48	48,2 KB
R1-163346.zip	2016/04/02 2:48	309,2 KB
R1-163347.zip	2016/04/02 2:48	19,9 KB
R1-163348.zip	2016/04/02 2:48	20,5 KB
R1-163349.zip	2016/04/01 16:18	39 KB
R1-163350.zip	2016/04/01 16:18	51,4 KB
R1-163351.zip	2016/04/02 5:59	41 KB
R1-163352.zip	2016/04/02 5:59	45,2 KB
R1-163353.zip	2016/04/02 5:59	63,7 KB
R1-163354.zip	2016/04/02 5:59	41,7 KB
R1-163355.zip	2016/04/02 5:59	94 KB
R1-163357.zip	2016/04/02 5:59	22,7 KB
R1-163359.zip	2016/04/02 5:59	91,5 KB
R1-163360.zip	2016/04/02 5:59	55,1 KB
R1-163361.zip	2016/04/02 5:59	60,2 KB
R1-163362.zip	2016/04/02 5:59	35,8 KB
R1-163363.zip	2016/04/01 21:09	58,9 KB
R1-163364.zip	2016/04/01 21:09	47,8 KB
R1-163365.zip	2016/04/01 21:09	52,1 KB
R1-163366.zip	2016/04/01 20:58	46,2 KB
R1-163367.zip	2016/04/02 9:16	95 KB
R1-163368.zip	2016/04/02 9:16	95,1 KB
R1-163369.zip	2016/04/03 20:43	10,1 KB
R1-163370.zip	2016/04/03 20:43	64,8 KB
R1-163371.zip	2016/04/03 20:43	33,3 KB
R1-163372.zip	2016/04/03 20:43	9,7 KB
R1-163373.zip	2016/04/03 20:43	16 KB
R1-163374.zip	2016/04/03 20:43	12 KB
R1-163375.zip	2016/04/03 20:43	526 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-163376.zip	2016/04/05 13:48	24,9 KB
R1-163377.zip	2016/04/04 7:12	72 KB
R1-163378.zip	2016/04/07 17:13	1017,9 KB
R1-163379.zip	2016/04/07 8:06	356 KB
R1-163380.zip	2016/04/04 16:52	497,6 KB
R1-163381.zip	2016/04/05 13:48	183,9 KB
R1-163382.zip	2016/04/06 16:29	229,3 KB
R1-163383.zip	2016/04/06 9:00	137,7 KB
R1-163384.zip	2016/04/07 6:39	19,1 KB
R1-163385.zip	2016/04/07 6:39	32,9 KB
R1-163386.zip	2016/04/07 6:39	40,8 KB
R1-163387.zip	2016/04/06 16:36	179,2 KB
R1-163388.zip	2016/04/05 13:48	25 KB
R1-163389.zip	2016/04/05 14:54	90,5 KB
R1-163390.zip	2016/04/05 14:28	33,3 KB
R1-163391.zip	2016/04/22 13:02	34,5 KB
R1-163392.zip	2016/04/07 13:06	295,4 KB
R1-163393.zip	2016/04/08 16:03	422,8 KB
R1-163394.zip	2016/04/18 9:44	75,8 KB
R1-163395.zip	2016/04/07 12:53	2074,5 KB
R1-163396.zip	2016/04/08 7:59	70,4 KB
R1-163397.zip	2016/04/18 9:44	35,9 KB
R1-163399.zip	2016/04/18 9:44	985,4 KB
R1-163400.zip	2016/04/18 9:44	367,7 KB
R1-163401.zip	2016/04/18 9:44	340 KB
R1-163402.zip	2016/04/18 9:44	423,1 KB
R1-163403.zip	2016/04/08 16:03	609,3 KB
R1-163404.zip	2016/04/18 9:44	183,7 KB
R1-163405.zip	2016/04/18 9:44	107,7 KB
R1-163406.zip	2016/04/18 9:44	1018 KB
R1-163407.zip	2016/04/18 9:44	852,2 KB
R1-163408.zip	2016/04/18 9:44	384,2 KB
R1-163409.zip	2016/04/18 9:44	100,2 KB
R1-163410.zip	2016/04/18 9:44	1240,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163412.zip	2016/04/18 9:43	1288,8 KB
R1-163413.zip	2016/04/18 9:43	32,1 KB
R1-163414.zip	2016/04/18 9:43	27 KB
R1-163415.zip	2016/04/18 9:43	82,1 KB
R1-163416.zip	2016/04/18 9:43	153,8 KB
R1-163417.zip	2016/04/18 9:43	43,6 KB
R1-163418.zip	2016/04/18 9:43	501,8 KB
R1-163419.zip	2016/04/18 9:43	148,1 KB
R1-163420.zip	2016/04/18 9:43	31,7 KB
R1-163421.zip	2016/04/18 9:43	76 KB
R1-163422.zip	2016/04/18 9:43	188,1 KB
R1-163423.zip	2016/04/18 9:43	81,5 KB
R1-163424.zip	2016/04/18 9:43	121,8 KB
R1-163425.zip	2016/04/18 9:43	302,4 KB
R1-163426.zip	2016/04/18 9:43	65,7 KB
R1-163427.zip	2016/04/18 9:43	109,4 KB
R1-163428.zip	2016/04/18 9:43	80,1 KB
R1-163429.zip	2016/04/18 9:43	82,8 KB
R1-163430.zip	2016/04/18 9:43	97,8 KB
R1-163431.zip	2016/04/18 9:43	29,3 KB
R1-163432.zip	2016/04/18 9:43	93,8 KB
R1-163433.zip	2016/04/18 9:43	56,7 KB
R1-163434.zip	2016/04/18 9:43	89,4 KB
R1-163435.zip	2016/04/18 9:43	65,2 KB
R1-163436.zip	2016/04/18 9:43	41,5 KB
R1-163437.zip	2016/04/18 9:43	668,1 KB
R1-163439.zip	2016/04/18 9:43	36,7 KB
R1-163440.zip	2016/04/18 9:43	41,4 KB
R1-163441.zip	2016/04/18 9:43	34 KB
R1-163442.zip	2016/04/18 9:43	44,3 KB
R1-163443.zip	2016/04/18 9:42	33,6 KB
R1-163444.zip	2016/04/18 9:42	33 KB
R1-163445.zip	2016/04/18 9:42	31,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163448.zip	2016/04/18 9:42	55,1 KB
R1-163449.zip	2016/04/18 9:42	21 KB
R1-163450.zip	2016/04/18 9:42	46,9 KB
R1-163451.zip	2016/04/18 9:42	37,4 KB
R1-163452.zip	2016/04/18 9:42	90,7 KB
R1-163453.zip	2016/04/18 9:42	9,4 KB
R1-163454.zip	2016/04/18 9:42	49,2 KB
R1-163455.zip	2016/04/18 9:42	57,7 KB
R1-163456.zip	2016/04/18 9:42	58,8 KB
R1-163457.zip	2016/04/22 13:02	46,6 KB
R1-163458.zip	2016/04/18 9:42	31,2 KB
R1-163461.zip	2016/04/18 9:42	19,7 KB
R1-163462.zip	2016/04/18 9:42	33,6 KB
R1-163463.zip	2016/04/18 9:42	16,7 KB
R1-163464.zip	2016/04/18 9:42	573 KB
R1-163466.zip	2016/04/18 9:42	152,6 KB
R1-163467.zip	2016/04/18 9:42	225,6 KB
R1-163468.zip	2016/04/18 9:42	113 KB
R1-163469.zip	2016/04/18 9:42	28,7 KB
R1-163470.zip	2016/04/18 9:42	20,6 KB
R1-163471.zip	2016/04/18 9:42	39,1 KB
R1-163472.zip	2016/04/18 9:42	113,7 KB
R1-163473.zip	2016/04/18 9:42	123,4 KB
R1-163474.zip	2016/04/18 9:42	67,3 KB
R1-163475.zip	2016/04/18 9:42	26,1 KB
R1-163476.zip	2016/04/18 9:42	76,9 KB
R1-163477.zip	2016/04/18 9:42	45,5 KB
R1-163478.zip	2016/04/18 9:42	182,7 KB
R1-163479.zip	2016/04/18 9:42	86,4 KB
R1-163480.zip	2016/04/18 9:42	250,1 KB
R1-163481.zip	2016/04/18 9:42	60,8 KB
R1-163482.zip	2016/04/18 9:42	85,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163484.zip	2016/04/18 9:42	26,6 KB
R1-163485.zip	2016/04/18 9:42	523,4 KB
R1-163486.zip	2016/04/18 9:42	36,9 KB
R1-163487.zip	2016/04/18 9:42	53,1 KB
R1-163488.zip	2016/04/18 9:42	808,4 KB
R1-163489.zip	2016/04/18 9:42	47,7 KB
R1-163490.zip	2016/04/18 9:42	161,8 KB
R1-163491.zip	2016/04/18 9:42	47,8 KB
R1-163492.zip	2016/04/18 9:42	164,5 KB
R1-163493.zip	2016/04/18 9:42	112,5 KB
R1-163494.zip	2016/04/18 9:42	38,8 KB
R1-163495.zip	2016/04/18 9:42	43,2 KB
R1-163496.zip	2016/04/18 9:42	44,9 KB
R1-163497.zip	2016/04/18 9:42	42,5 KB
R1-163498.zip	2016/04/18 9:42	53,1 KB
R1-163499.zip	2016/04/18 9:42	43,8 KB
R1-163500.zip	2016/04/18 9:42	100,1 KB
R1-163501.zip	2016/04/22 13:17	24 KB
R1-163502.zip	2016/04/18 9:42	33 KB
R1-163503.zip	2016/04/18 9:42	29,4 KB
R1-163504.zip	2016/04/18 9:41	38,3 KB
R1-163505.zip	2016/04/18 9:41	47,4 KB
R1-163506.zip	2016/04/18 9:41	25,2 KB
R1-163507.zip	2016/04/18 9:41	35,9 KB
R1-163508.zip	2016/04/18 9:41	94,6 KB
R1-163509.zip	2016/04/18 9:41	28,8 KB
R1-163510.zip	2016/04/18 9:41	128,3 KB
R1-163511.zip	2016/04/18 9:41	1291,8 KB
R1-163512.zip	2016/04/18 9:41	19,7 KB
R1-163513.zip	2016/04/18 9:41	22,8 KB
R1-163514.zip	2016/04/18 9:41	196,6 KB
R1-163515.zip	2016/04/18 9:41	44,3 KB
R1-163516.zip	2016/04/18 9:41	30,9 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-163517.zip	2016/04/18 9:41	128,4 KB
R1-163518.zip	2016/04/18 9:41	236 KB
R1-163519.zip	2016/04/18 9:41	63,6 KB
R1-163520.zip	2016/04/18 9:41	338,5 KB
R1-163521.zip	2016/04/18 9:41	66,5 KB
R1-163522.zip	2016/04/18 9:41	33,2 KB
R1-163523.zip	2016/04/18 9:41	40,1 KB
R1-163524.zip	2016/04/18 9:41	47,2 KB
R1-163525.zip	2016/04/18 9:41	31,2 KB
R1-163526.zip	2016/04/18 9:41	56,5 KB
R1-163527.zip	2016/04/18 9:41	52,6 KB
R1-163528.zip	2016/04/18 9:41	66,5 KB
R1-163530.zip	2016/04/18 9:41	36,8 KB
R1-163531.zip	2016/04/19 7:53	31,4 KB
R1-163532.zip	2016/04/18 9:41	19,1 KB
R1-163533.zip	2016/04/18 9:41	35,3 KB
R1-163534.zip	2016/04/18 9:41	33,3 KB
R1-163535.zip	2016/04/18 9:41	60,8 KB
R1-163536.zip	2016/04/18 9:41	42 KB
R1-163537.zip	2016/04/18 9:41	46,2 KB
R1-163538.zip	2016/04/18 9:41	52,3 KB
R1-163539.zip	2016/04/18 9:41	36,7 KB
R1-163541.zip	2016/04/18 9:41	33,9 KB
R1-163542.zip	2016/04/18 9:41	31,1 KB
R1-163543.zip	2016/04/18 9:41	525,8 KB
R1-163544.zip	2016/04/18 9:41	39,4 KB
R1-163545.zip	2016/04/18 9:41	101,4 KB
R1-163546.zip	2016/04/18 9:41	61,3 KB
R1-163547.zip	2016/04/18 9:41	94,3 KB
R1-163548.zip	2016/04/18 9:41	60,3 KB
R1-163549.zip	2016/04/18 9:41	25,3 KB
R1-163551.zip	2016/04/18 9:41	30,9 KB
R1-163552.zip	2016/04/18 9:41	44,5 KB
R1-163553.zip	2016/04/18 9:41	86 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163557.zip	2016/04/18 9:41	154,3 KB
R1-163558.zip	2016/04/18 9:41	178,6 KB
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R1-163561.zip	2016/04/18 9:40	52,6 KB
R1-163562.zip	2016/04/18 9:40	154,6 KB
R1-163563.zip	2016/04/18 9:40	28,8 KB
R1-163564.zip	2016/04/18 9:40	35 KB
R1-163565.zip	2016/04/18 9:40	29,6 KB
R1-163566.zip	2016/04/18 9:40	75,1 KB
R1-163567.zip	2016/04/18 9:40	22,7 KB
R1-163568.zip	2016/04/18 9:40	35,8 KB
R1-163569.zip	2016/04/18 9:40	49,8 KB
R1-163570.zip	2016/04/18 9:40	49,6 KB
R1-163571.zip	2016/04/18 9:40	29,1 KB
R1-163572.zip	2016/04/18 9:40	76,7 KB
R1-163573.zip	2016/04/18 9:40	88,9 KB
R1-163574.zip	2016/04/18 9:40	94,9 KB
R1-163575.zip	2016/04/18 9:40	30,6 KB
R1-163576.zip	2016/04/18 9:40	44,4 KB
R1-163577.zip	2016/04/18 9:40	139,4 KB
R1-163578.zip	2016/04/18 9:40	18,1 KB
R1-163579.zip	2016/04/18 9:40	32,2 KB
R1-163580.zip	2016/04/18 9:40	37,9 KB
R1-163581.zip	2016/04/18 9:40	64,1 KB
R1-163582.zip	2016/04/18 9:40	38,5 KB
R1-163583.zip	2016/04/18 9:40	185,1 KB
R1-163584.zip	2016/04/18 9:40	43,8 KB
R1-163585.zip	2016/04/18 9:40	85,6 KB
R1-163586.zip	2016/04/18 9:40	41,2 KB
R1-163587.zip	2016/04/18 9:40	60,7 KB

Petitioners' Exhibit 1007, p. 1377
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163598.zip	2016/04/18 9:40	47,6 KB
R1-163599.zip	2016/04/18 9:40	41,4 KB
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R1-163601.zip	2016/04/18 9:40	33,5 KB
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R1-163611.zip	2016/04/18 9:40	56,9 KB
R1-163612.zip	2016/04/18 9:40	37,6 KB
R1-163613.zip	2016/04/18 9:40	57,7 KB
R1-163614.zip	2016/04/18 9:40	39,8 KB
R1-163615.zip	2016/04/18 9:40	37,1 KB
R1-163616.zip	2016/04/18 9:40	104,8 KB
R1-163617.zip	2016/04/18 9:39	25,8 KB
R1-163618.zip	2016/04/18 9:39	26,1 KB
R1-163619.zip	2016/04/18 9:40	1807,6 KB
R1-163620.zip	2016/04/18 9:39	61,4 KB
R1-163621.zip	2016/04/18 9:39	31,9 KB
R1-163622.zip	2016/04/18 9:39	29,1 KB
R1-163623.zip	2016/04/18 9:39	39,8 KB
R1-163624.zip	2016/04/18 9:39	135,6 KB

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IPR2024-01121

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R1-163629.zip	2016/04/18 9:39	59,9 KB
R1-163630.zip	2016/04/18 9:39	40,6 KB
R1-163631.zip	2016/04/18 9:39	42,2 KB
R1-163632.zip	2016/04/18 9:39	39,4 KB
R1-163633.zip	2016/04/18 9:39	37,9 KB
R1-163634.zip	2016/04/18 9:39	38,1 KB
R1-163635.zip	2016/04/18 9:39	46 KB
R1-163636.zip	2016/04/18 9:39	296,4 KB
R1-163637.zip	2016/04/18 9:39	38,8 KB
R1-163638.zip	2016/04/18 9:39	43 KB
R1-163639.zip	2016/04/18 9:39	29 KB
R1-163640.zip	2016/04/18 9:39	27,6 KB
R1-163641.zip	2016/04/18 9:39	43,7 KB
R1-163642.zip	2016/04/18 9:39	43,5 KB
R1-163643.zip	2016/04/18 9:39	161,6 KB
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R1-163651.zip	2016/04/18 9:39	52,3 KB
R1-163652.zip	2016/04/18 9:39	42,8 KB
R1-163653.zip	2016/04/18 9:39	39,5 KB
R1-163654.zip	2016/04/18 9:39	35,9 KB
R1-163655.zip	2016/04/22 13:02	65,1 KB
R1-163656.zip	2016/04/18 9:39	49,8 KB
R1-163657.zip	2016/04/18 9:39	221,7 KB
R1-163658.zip	2016/04/18 9:39	69,2 KB
R1-163659.zip	2016/04/18 9:39	11,2 KB
R1-163660.zip	2016/04/18 9:39	25,4 KB
R1-163661.zip	2016/04/18 9:39	63,9 KB
R1-163662.zip	2016/04/18 9:39	54,6 KB
R1-163663.zip	2016/04/18 9:39	57,3 KB
R1-163664.zip	2016/04/18 9:39	31,3 KB

Petitioners' Exhibit 1007, p. 1379
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163670.zip	2016/04/18 9:39	38,3 KB
R1-163671.zip	2016/04/18 9:39	43,8 KB
R1-163672.zip	2016/04/18 15:48	31,5 KB
R1-163673.zip	2016/04/18 9:39	49,4 KB
R1-163676.zip	2016/04/18 9:39	20,2 KB
R1-163677.zip	2016/04/18 9:39	57,1 KB
R1-163678.zip	2016/04/18 9:39	26,8 KB
R1-163679.zip	2016/04/18 9:39	21,6 KB
R1-163680.zip	2016/04/18 9:39	19,7 KB
R1-163681.zip	2016/04/18 9:39	34,1 KB
R1-163682.zip	2016/04/18 9:39	47,6 KB
R1-163683.zip	2016/04/18 9:39	29,4 KB
R1-163684.zip	2016/04/18 9:39	31,5 KB
R1-163685.zip	2016/04/18 9:39	10,8 KB
R1-163686.zip	2016/04/18 9:39	10,9 KB
R1-163687.zip	2016/04/18 9:39	37,7 KB
R1-163688.zip	2016/04/18 9:39	19,8 KB
R1-163689.zip	2016/04/18 9:39	35,5 KB
R1-163690.zip	2016/04/18 9:39	41,4 KB
R1-163691.zip	2016/04/18 9:39	40,8 KB
R1-163692.zip	2016/04/18 9:39	14,5 KB
R1-163693.zip	2016/04/18 9:39	14,5 KB
R1-163694.zip	2016/04/18 9:39	112,5 KB
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R1-163697.zip	2016/04/18 9:39	86,1 KB
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R1-163700.zip	2016/04/18 9:39	39,2 KB
R1-163701.zip	2016/04/18 9:38	54 KB
R1-163702.zip	2016/04/18 9:38	32,6 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163707.zip	2016/04/18 9:38	30,2 KB
R1-163708.zip	2016/04/18 9:38	32,6 KB
R1-163709.zip	2016/04/18 9:38	35,9 KB
R1-163710.zip	2016/04/18 9:38	60 KB
R1-163711.zip	2016/04/18 9:38	55,8 KB
R1-163712.zip	2016/04/18 9:38	47 KB
R1-163713.zip	2016/04/18 9:38	39,4 KB
R1-163714.zip	2016/04/18 9:38	44,7 KB
R1-163715.zip	2016/04/18 9:38	169,1 KB
R1-163716.zip	2016/04/18 9:38	13,9 KB
R1-163717.zip	2016/04/18 9:38	519,1 KB
R1-163718.zip	2016/04/18 9:38	65,8 KB
R1-163719.zip	2016/04/18 9:38	126,3 KB
R1-163720.zip	2016/04/18 9:38	31,2 KB
R1-163721.zip	2016/04/18 9:38	44,3 KB
R1-163722.zip	2016/04/18 9:38	36,6 KB
R1-163723.zip	2016/04/18 9:38	38 KB
R1-163724.zip	2016/04/18 9:38	31,1 KB
R1-163725.zip	2016/04/18 9:38	41,6 KB
R1-163726.zip	2016/04/18 9:38	58,1 KB
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R1-163731.zip	2016/04/18 9:38	32,1 KB
R1-163732.zip	2016/04/18 9:38	130 KB
R1-163733.zip	2016/04/18 9:38	31,6 KB
R1-163734.zip	2016/04/18 9:38	37,9 KB
R1-163735.zip	2016/04/18 9:38	85,5 KB
R1-163736.zip	2016/04/18 9:38	33,8 KB
R1-163737.zip	2016/04/18 9:38	54,9 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-163747.zip	2016/04/18 9:38	41,7 KB
R1-163748.zip	2016/04/18 9:38	40,7 KB
R1-163749.zip	2016/04/18 9:38	12 KB
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R1-163752.zip	2016/04/18 9:38	32,2 KB
R1-163753.zip	2016/04/18 9:38	36,4 KB
R1-163754.zip	2016/04/18 9:38	39,6 KB
R1-163755.zip	2016/04/18 9:38	35,8 KB
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R1-163757.zip	2016/04/18 9:38	41,5 KB
R1-163758.zip	2016/04/18 9:38	34,8 KB
R1-163759.zip	2016/04/18 9:38	75,1 KB
R1-163760.zip	2016/04/18 9:38	112 KB
R1-163762.zip	2016/04/22 13:02	30,5 KB
R1-163763.zip	2016/04/18 9:38	24,5 KB
R1-163765.zip	2016/04/18 9:38	53,1 KB
R1-163766.zip	2016/04/18 9:38	54,6 KB
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R1-163770.zip	2016/04/18 9:38	97,2 KB
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R1-163772.zip	2016/04/18 9:38	57 KB
R1-163773.zip	2016/04/18 9:38	27,5 KB
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R1-163775.zip	2016/04/18 9:38	16,9 KB
R1-163776.zip	2016/04/18 9:38	45,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163780.zip	2016/04/18 9:38	30 KB
R1-163781.zip	2016/04/18 9:38	29,2 KB
R1-163782.zip	2016/04/18 9:38	43,8 KB
R1-163783.zip	2016/04/18 9:38	26,8 KB
R1-163784.zip	2016/04/18 9:37	26,7 KB
R1-163785.zip	2016/04/18 9:37	29,6 KB
R1-163786.zip	2016/04/18 9:37	18,7 KB
R1-163787.zip	2016/04/18 9:37	26,9 KB
R1-163788.zip	2016/04/18 9:37	38,4 KB
R1-163789.zip	2016/04/18 9:37	45,9 KB
R1-163790.zip	2016/04/18 9:37	63,9 KB
R1-163791.zip	2016/04/18 9:37	10 KB
R1-163792.zip	2016/04/18 9:37	1293,1 KB
R1-163793.zip	2016/04/18 9:37	29,6 KB
R1-163794.zip	2016/04/18 9:37	37,2 KB
R1-163795.zip	2016/04/18 9:37	38,5 KB
R1-163796.zip	2016/04/18 9:37	25,6 KB
R1-163797.zip	2016/04/18 9:37	82,5 KB
R1-163798.zip	2016/04/22 13:02	199,3 KB
R1-163799.zip	2016/04/18 9:37	33,8 KB
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R1-163803.zip	2016/04/18 9:37	56,3 KB
R1-163804.zip	2016/04/18 9:37	97,1 KB
R1-163805.zip	2016/04/18 9:37	31,9 KB
R1-163806.zip	2016/04/18 9:37	36,9 KB
R1-163807.zip	2016/04/18 9:37	20,8 KB
R1-163808.zip	2016/04/18 9:37	16 KB
R1-163809.zip	2016/04/18 9:37	32 KB
R1-163810.zip	2016/04/18 9:37	50,6 KB
R1-163811.zip	2016/04/18 9:37	27,5 KB

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R1-163815.zip	2016/04/18 9:37	36,9 KB
R1-163816.zip	2016/04/18 9:37	38,5 KB
R1-163817.zip	2016/04/18 9:37	52,3 KB
R1-163818.zip	2016/04/18 9:37	33,1 KB
R1-163819.zip	2016/04/18 9:37	47,8 KB
R1-163820.zip	2016/04/18 9:37	165,3 KB
R1-163821.zip	2016/04/18 9:37	294,5 KB
R1-163822.zip	2016/04/18 9:37	50,7 KB
R1-163823.zip	2016/04/18 9:37	52 KB
R1-163824.zip	2016/04/18 9:37	47,5 KB
R1-163826.zip	2016/04/18 9:37	66,1 KB
R1-163827.zip	2016/04/18 9:37	46,6 KB
R1-163828.zip	2016/04/18 9:37	99,1 KB
R1-163829.zip	2016/04/22 13:02	66 KB
R1-163830.zip	2016/04/18 9:37	44,3 KB
R1-163831.zip	2016/04/18 9:37	34,4 KB
R1-163832.zip	2016/04/18 9:37	76,6 KB
R1-163833.zip	2016/04/18 9:37	81 KB
R1-163834.zip	2016/04/18 9:37	74 KB
R1-163835.zip	2016/04/18 9:37	45,1 KB
R1-163836.zip	2016/04/18 9:37	16,3 KB
R1-163837.zip	2016/04/18 9:37	100,4 KB
R1-163838.zip	2016/04/18 9:37	103,5 KB
R1-163839.zip	2016/04/18 9:37	94,5 KB
R1-163840.zip	2016/04/18 9:37	89,6 KB
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R1-163842.zip	2016/04/18 9:37	90,5 KB
R1-163843.zip	2016/04/18 9:37	108,9 KB
R1-163844.zip	2016/04/18 9:37	35,8 KB
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sort by name/desc	sort by date/desc	sort by size/desc
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R1-163853.zip	2016/04/18 9:36	101,7 KB
R1-163854.zip	2016/04/18 9:36	47,8 KB
R1-163855.zip	2016/04/22 13:08	43,2 KB
R1-163856.zip	2016/04/22 13:08	39,5 KB
R1-163857.zip	2016/04/18 9:36	38,2 KB
R1-163858.zip	2016/04/18 9:36	83,2 KB
R1-163859.zip	2016/04/18 9:36	206,6 KB
R1-163860.zip	2016/04/18 9:36	19,7 KB
R1-163861.zip	2016/04/18 9:36	50,4 KB
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TDoc_List_Meeting_RAN1#84-BIS.xlsx	2022/01/10 15:29	431,3 KB
TDoc_List_Meeting_RAN1#84-BIS.zip	2018/01/10 16:44	790 KB

1790 items.

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APPENDIX 28

3GPP_TSG_RAN_WG1 Archives
April 2016, Week 3

3GPP_TSG_RAN_WG1@LIST.ETSI.ORG

Options: Use Monospaced Font
Show Text Part by Default
Show All Mail Headers

Message: [<< First] [< Prev] [Next >] [Last >>]
Topic: [<< First] [< Prev] [Next >] [Last >>]
Author: [<< First] [< Prev] [Next >] [Last >>]

Subject: [RAN1#84bis]: Minutes from Busan
From: Patrick Merias <[log in to unmask]>
Reply To: Patrick Merias <[log in to unmask]>
Date: Thu, 21 Apr 2016 17:25:19 +0000
Content-Type: multipart/mixed
Parts/Attachments: text/plain (1666 bytes) , text/html (62 kB) ,
Draft_Minutes_report_RAN1#84bis_v010.zip (644 kB)

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Dear all,

Please find a preliminary version of last week report…
It is far from being the final version as still a lot from Friday's review need to be incorporated (some of my hand-written notes are not in).
Nevertheless all available Tdocs have been uploaded – and a first version of Tdoc_list is available in 3GU – I uploaded the list only today after having checked the almost 1800 documents submitted in RAN1#84bis … A number of discrepancies needed to be fixed before uploading it

Still I miss the following (these are listed in Chair's notes – likely from // sessions – but do not exist !!)

R1-163457	WF on CSI-RS RE density for non-precoded CSI-RS	Samsung, Nokia, Alcatel-Lucent Shanghai Bell, NEC, LGE, ZTE, ETRI, NTT DOCOMO, Huawei	7.3.3.1.1			reserved	2016-04-11 12:00:00			-								
R1-163465	PUSCH Performance with short TTIs	MediaTek	7.3.10.2			reserved	2016-04-11 12:00:00			-								
R1-163655	WF on Hybrid CSI Reporting	Samsung, Alcatel-Lucent Shanghai Bell, CATT, Nokia, Qualcomm, LG Electronics, Beijing Xinwei, Interdigital, AT&T, China Telecom, Huawei, HiSilicon, CMCC, CATR, Ericsson	7.3.3.2.2			reserved	2016-04-12 12:00:00			-								
R1-163674	CR for TS36.211 related to 2+4 PRB se	Panasonic	7.1.5			reserved	2016-04-12 12:00:00			**R1-163858**								
R1-163675	CR for TS36.213 related to 2+4 PRB se	Panasonic	7.1.5			reserved	2016-04-12 12:00:00			**R1-163859**								
R1-163762	WF on uplink power control in LAA	LGE	7.3.1.6			reserved	2016-04-13 12:00:00			-								
R1-163829	WF on further details of DCI contents for multi-TTI transmission	Qualcomm	7.3.1.1			reserved	2016-04-14 12:00:00			-								

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ATOM RSS1 RSS2

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IPR2024-01121

APPENDIX 29

3GPP TSG RAN WG1 Meeting #85 **R1-16xxxx**
Nanjing, China, 23rd – 27th May 2016

Source:	**MCC Support**
Title:	**Draft Report of 3GPP TSG RAN WG1 #84bis v0.1.0 (Busan, Korea, 11th – 15th April 2016)**
Document for:	**Commentl**



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Nanjing, China, 23rd – 27th May 2016

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3GPP TSG RAN WG1 Meeting #85 **R1-16xxxx**
Nanjing, China, 23rd – 27th May 2016

Main facts summary

3GPP TSG WG RAN1 #84 bis meeting, hosted by Samsung, was held in Haeundae Grand Hotel in Busan, Korea.
The meeting started at 9:05 on Monday 11th April and finished at 17:15 on Friday 15th April 2016.
The number of attending delegates, having signed the participants' paper list, was **387.**

The schedule of the week was as follows:

- Monday: Common session on Agenda items 1, 2, 3, 4, 5, 7.1.2 (Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers), 7.1.3 (Maintenance of Release 13 LAA) and 7.1.4 (Maintenance of Release 13 EB/FD-MIMO) followed by Study on Latency reduction techniques (AI 7.3.10.1 on Evaluation results, AI 7.3.10.2 on Channel design for shortened TTI)
- Monday afternoon (LTE)
  - Session on NB-IoT (AI 7.2.1) chaired by Matthew Baker.

- Tuesday (NR): chaired by Satoshi Nagata
- Tuesday (LTE session1): chaired by Matthew Baker
  - eMBMS enhancements for LTE (AI 7.3.5), SRS Carrier Based Switching for LTE (AI 7.3.6) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Tuesday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (and possibly other CRs (e.g., LAA, MIMO, eCA), Further Indoor Positioning enhancements for UTRA and LTE (AI 7.3.7), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Tuesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Tuesday (HSPA): Multi-Carrier enhancements for UMTS (AI 6.2) chaired by Carmela Cozzo from Huawei.

- Wednesday (LTE)
  - Rel-13 CRs (LAA, MIMO), Support for V2V services based on LTE sidelink (AI 7.3.2), Study on Latency reduction techniques (AI 7.3.4) and Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) chaired by Satoshi Nagata on one hand.
  - Rel-13 eMTC CRs chaired by Wanchi Chen followed by a session on NB-IoT (AI 7.2.1) chaired by Matthew Baker on the other hand.
- Wednesday (HSPA): DTX/DRX enhancements in CELL_FACH (AI 6.3) chaired by Florent Munier from Ericsson followed by Maintenance and revisions chaired by Carmela Cozzo from Huawei.

- Thursday (LTE):
  - Study on LTE-based V2X Services (AI 7.3.3), Study on Latency reduction techniques (AI 7.3.4), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2) chaired by Satoshi Nagata on one hand.
  - Rel-13 eMTC CRs (and possibly other CRs (e.g., LAA, MIMO, eCA) chaired by Wanchi Chen followed by Study on channel model for frequency spectrum above 6 GHz (AI 7.3.5) chaired by Tuomo Säynäjäkangas from Nokia on the other hand.
- Thursday afternoon (LTE)
  - Session on NB-IoT (AI 7.2.1) chaired by Matthew Baker.

- Friday: Revisions. Again finalization of eMTC CRs and continued NB-IoT in the morning.

The list of action points that required RAN1 close follow-up is listed in Annex F (end of document).

The number of contribution documents for this meeting was xxx, and those documents were categorized as followed.

Agenda Item	Input Document	Discussed Document

Note: The amount of documents includes those discussed during the email discussion session post meeting.

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3GPP TSG RAN WG1 Meeting #85 **R1-16xxxx**
Nanjing, China, 23rd – 27th May 2016

1 Opening of the meeting

Mr Satoshi Nagata (RAN1 Chairman) welcomed the participants of the RAN WG1 84 bis meeting and opened the meeting at 09:00.
Mr Younsun Kim welcomed the delegates on behalf of Samsung and detailed the domestic arrangements for the full week. The host kindly offered buffet lunch to all RAN1 delegates.

1.1 Call for IPR

The attention of the members of this Technical Specification Group was drawn to the fact ***that 3GPP Individual Members have the obligation*** *under the IPR Policies of their respective Organizational Partners to* ***inform their respective*** *Organizational Partners* ***of Essential IPRs they become aware of****.*
The members take note that they are hereby invited:

- *to investigate whether their organization or any other organization owns IPRs which were, or were likely to become Essential in respect of the work of 3GPP.*
- *to notify their respective Organizational Partners of all potential IPRs, e.g., for ETSI, by means of the IPR Information Statement and the Licensing declaration forms (e.g. see the ETSI IPR forms http://webapp.etsi.org/Ipr/).*

1.2 Competition law statement

The Chairman also drew Member's attention to the fact that 3GPP activities are subject to antitrust and competition laws and that compliance with said laws is therefore required of any participant of this WG meeting including the Chairman and Vice Chairmen.
In case of question, please contact your legal counsel.
The present meeting will be conducted with strict impartiality and in the interests of 3GPP.
Furthermore, the Chairman reminded Members that timely submission of work items/contributions in advance of WG meetings is important to allow for full and fair consideration of such matters.

1.3 Network usage conditions

The PCG has laid down the following network usage conditions:

Users shall not use the network to engage in illegal activities. This includes activities such as copyright violation, hacking, espionage or any other activity that may be prohibited by local laws.

Users shall not engage in non-work related activities that consume excessive bandwidth or cause significant degradation of the performance of the network.
Since the **network is a shared resource**, users should exercise some basic etiquette when using the 3GPP network at a meeting. It is understood that high bandwidth applications such as downloading large files or video streaming might be required for business purposes, but delegates should be strongly discouraged in performing these activities for personal use. Downloading a movie or doing something in an interactive environment for personal use essentially wastes bandwidth that others need to make the meeting effective. The meeting chairman should remind end users that the network is a shared resource; the more one user grabs, the less there is for another. Email and its attachments already take up significant bandwidth (certain email programs are not very bandwidth efficient). In case of need the chair can ask the delegates to restrict IT usage to things that are essential for the meeting itself.

1. DON'T place your WiFi device in ad-hoc mode
2. DON'T set up a personal hotspot in the meeting room
3. DO try 802.11a if your WiFi device supports it
4. DON'T manually allocate an IP address
5. DON'T be a bandwidth hog by streaming video, playing online games, or downloading huge files
6. DON'T use packet probing software which clogs the local network (e.g., packet sniffers or port scanners)

2 Approval of Agenda

R1-162141 Draft Agenda of RAN1#84bis meeting RAN1 Chair
Satoshi Nagata (Chairman) proposed the agenda for the meeting, as well the schedule of the week.
Discussion: Fujitsu → for NR and NB-IoT, more details of the topics for discussion might be helpful
Panasonic who will be chairing the different sessions? NB-IoT (Monday) chaired by Matthew Baker, NB-IoT (Tuesday, Wed) chaired by Brian Classon – all NR sessions will be chaired by RAN1 chair – all others topics be split betwwen both RAN1 Vice Chairmen.
Mr Chair highlighted the difficulty to satisfy every one wishes while preparing the schedule of the week

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ZTE sees an issue having certain topics discussed in // between channel model and NR sessions→ Chair: schecule can be revisited during the week based on the progress.
Decision: The agenda is approved.

3 Approval of Minutes from previous meetings

R1-163406 Final Report of 3GPP TSG RAN WG1 #84 v2.0.0 ETSI (R1-163378)
The document was presented by Patrick Mérias (ETSI Mobile Competence Center) and provides the outcomes of last meeting in Malta.
Discussion: MCC→ report is revised to correct a formating issue in the conclusion of the email thread [84-11].
MCC apologized for having forgotten two agreed CRs in the LTE_EBF_FDMIMO CR pack to RAN#71. Both CRs are resubmitted at this meeting (see below) and will go for approval by next plenarybefore inclusion into the specs.
Decision: The document is approved.
R1-162341 CR on CSI-RS transmission in DwPTS Samsung 36.211 CR0216r2
Decision: The document is agreed.
R1-162342 Correction to the UE's assumption on DMRS ports ZTE 36.213 CR0593r1
Decision: The document is agreed.

R1-163379 Final Report of 3GPP TSG RAN WG1 #2AH_NB-IoT v1.0.0 ETSI
The document was presented by Patrick Mérias (ETSI Mobile Competence Center) and provides the outcomes of last meeting in Anaheim.
Discussion: No comment.
Decision: The document is approved.

R1-162190 Draft Report of 3GPP TSG RAN WG1 #AH Channel Model Nokia
The document was presented by Tuomo Säynäjäkangas from Nokia and provides the outcomes of the ad-hoc meeting in Ljubljana.
Discussion: No comment.
Decision: The document is approved.

4 Highlights from RAN Plenary

R1-163377 Selected highlights from RAN#71 of relevance to RAN1 RAN1 Chair
The document was presented by RAN1 Chair and shows the main decisions from RAN#71 impacting RAN1 future work.
Decision: The document is noted.

5 Incoming Liaison Statements

Dual connectivity related
R1-163370 Response LS on maximum UL Transmission timing difference in dual connectivity RAN2, Huawei
The document was presented by RAN1 Chair on behalf of Huawei and suggests RAN4 to consider the following 2 scenarii simultaneously:

- *Scenario 1 (addressed in TS 36.331): the pTAG in SCG is impacted due to exceeding the maximum uplink transmission timing difference between MCG and SCG when powerControlMode is configured to 1;*
- *Scenario 2 (addressed in TS36.321): only the SCell of sTAG is impacted due to exceeding the maximum uplink transmission timing difference between MCG and SCG when powerControlMode is configured to 1;*

Discussion: No action to RAN1.
Decision: The document is noted.

R1-163372 Reply LS on Pcmax definition of asynchronous overlapping transmissions in DC RAN4, InterDigital
The document was presented by Paul Marinier from InterDigital and provides the following answers to R1-153460.

- The statement ”power control changes are not allowed for one channel on one carrier in the middle of subframe” is correct and this is the RAN4 understanding as well, as the legacy Pcmax,c per carrier/per CG is applicable in RAN4 DC related specification.
- The Pcmax of a non-reference subframe does not change at the border of 2 reference subframes.

Decision: The document is noted.

LAA related
R1-163375 Liaison Statement to 3GPP from IEEE 802 LMSC IEEE 802 LMSC
The document was presented by RAN1 Chair on behalf of IEEE 802 and is an LS containing comments related to the LAA specification prepared by the 802.19 Coexistence Working Group. The document contains comments by participants in IEEE 802,

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particularly focused on CR_R1_157922 [36.213] and CR_RP_152258 [36.211] in the interest of improving the performance of all systems, including LAA, in unlicensed spectrum.
IEEE 802 believes this process of collaboration will result in an LAA specification that better supports fair sharing of unlicensed spectrum by both 802.11 and LAA equipment. Further, it will also result in a better LAA specification that leverages the long experience of IEEE 802 in defining effective and fair sharing protocols in unlicensed spectrum.
Discussion: Qualcomm is preparing a draft reply in R1-163413 (not yet ready).
Decision: The document is noted. Continue offline and contact Qualcomm – revisit by Friday
Friday
R1-163413 **Draft response LS to 802dot11 regarding LAA** **Qualcomm Incorporated**
The document was presented by Peter Gaal from Qualcomm.
Discussion: .More offline comments provided by Huawei and Broadcom… Qualcomm: they have not been captured yet.
Just before closing the meeting, Broadcom raised the issue that some of the questions may be more appropriate to RAN4 and one particular to RAN2. Qualcomm does not agree and believe RAN1 can (should) cover all of them.
Decision: The document is noted. Reply LS will be discussed at the next meeting.

R1-163388 **Liaison Statement regarding LAA** **Wi-Fi Alliance Coexistence Task Group**
The document was presented by RAN1 Chair on behalf of WFA and provides some comments on the LAA specification aimed at ensuring good coexistence between LAA and Wi-Fi. In addition, Wi-Fi Alliance highlights and provides complementary analysis on some of the comments contained in [R1-163375], which it believes are important to help ensure fair sharing and efficient use of unlicensed spectrum by LAA and Wi-Fi devices.
Discussion: Similar to previous LS, Qualcomm is preparing a draft reply in R1-163414 (not yet available).
Decision: The document is noted. Continue offline and contact Qualcomm – revisit by Friday
Friday
R1-163414 **Draft response LS to Wi-Fi Alliance regarding LAA** **Qualcomm Incorporated**
The document was presented by Peter Gaal from Qualcomm.
Discussion: Qualcomm still need to consider some additional comments posted on the email refelctor.
Decision: The document is noted. Reply LS will be discussed at the next meeting.

eMTC related
R1-163369 **Response LS on Paging for MTC RAN2, Ericsson**
The document was presented by Johan Bergman from Ericsson and reports the RAN2 agreements to introduce

- new UE category M1 (corresponding to the Rel-13 low complexity MTC capability), and
- new UE capabilities for CE Mode A and CE Mode B (corresponding to the Enhanced Coverage capability) into existing Inter-node RRC message UERadioPagingInformation (TS36.331).
- a new Inter-node RRC message UEPagingCoverageInformation into TS36.331, for the purpose to upload enhanced coverage information from eNB to EPS (MME), and to be downloaded to eNB(s) at paging.

Discussion: No action to RAN1.
Decision: The document is noted.

V2X related
R1-163373 **LS on V2V Requirements** **RAN, Qualcomm, LG Electronics**
The document was presented by Hanbyul Seo from LGE and asks RAN1 to take the potential requirements in [ETSI EN 302 571, "Intelligent Transport Systems (ITS)"], in particular the PSD limitation (assuming approximately 23dBm maximum Tx power UE, but not precluding the addition of higher Tx power UE in future), into consideration.
Discussion: Intel → what "future" means here? LGE: 23dBm maximum Tx power UE is already captured in the WID
Decision: The document is noted.

R1-163374 **Reply LS on clarification of RSU types** **SA1, LG Electronics**
The document was presented by Hanbyul Seo from LGE and confirms that there are two types of Road Side Unit defined as follows in TS 22.185.

> **Road Side Unit**: A stationary infrastructure entity supporting V2X applications that can exchange messages with other entities supporting V2X applications.
> *Note: RSU is a term frequently used in existing ITS specifications, and the reason for introducing the term in the 3GPP specifications is to make the documents easier to read for the ITS industry. RSU is a logical entity that combines V2X application logic with the functionality of an eNB (referred to as eNB-type RSU) or UE (referred to as UE-type RSU)*

Decision: The document is noted.

PRACH enhancement in high speed scenario
R1-163371 **LS on A New PRACH Cyclic Shift Restriction Set** **RAN4, Nokia**
The document was presented by Jari Lindholm from Nokia and asks RAN1to investigate whether the new restricted set of cyclic shifts for extra high speed cells proposed at Section 6.5.3.1 in [TS 36.878] and the solution proposed in [R4-152604] are suitable for supporting uplink Doppler offset, at least, up to +/-2.5KHz, and if the proposed new restricted set of cyclic shifts for extra high speed cells is a suitable solution, RAN4 would ask RAN1 to consider introducing the new restricted set into TS 36.211 in Rel-14.

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Decision: The document is noted.

R1-162619 PRACH enhancement in high speed scenario Huawei, HiSilicon

The document was presented by Guo Zhiheng from Huawei and is summarized as follows:

- Observation 1: Solution 1 (only use the root sequence without cyclic shifts) requires no UE enhancement and has no specification impact with the drawback that the number of available preamble sequence is very limited.
- Observation 2: *highSpeedFlag* should only be used for the unrestricted set or restricted set selection.
- Observation 3: Solution 2 (define new restricted set of cyclic shift) needs UE enhancement with the advantage that the root sequence with cyclic shift could be used as random access preamble.
- Observation 4: the valid random access sequence number of solutions 2 and 3 (improved new restricted set of cyclic shift) is larger than solution 1 and the number of available random access sequence of solution 3 is almost twice of solution 2.
- Observation 5: the number of available random access sequence of solution 2 is less than solution 1 while $N_{CS} \geq 55$.
- Proposal: adopting solution 3 (improved new restricted set of cyclic shift) as PRACH enhancement solution.

Discussion: RAN1 Chair: what does this proposal aim to? Huawei→ to open the technical discussion.
Decision: The document is noted.

R1-162766 Considerations for PRACH options related to LS R4-161254 Ericsson

The document was presented by Daniel Larsson from Ericsson and shows an analysis of the different options in the LS [R1-163371] by comparison with options available using current specification. It shows that we can reach similar maximum Doppler, 3250 Hz, which corresponds to 650 km/h assuming a carrier frequency of 2.7 GHz in two ways. The first option is to add two additional hypotheses to get three in total. This has the advantage of being backwards compatible. However the PRACH capacity will suffer due to the risk of the BS sending the wrong responses, even if this can be mitigated by grouping explained in [R4-158133].
Decision: The document is noted.

R1-163199 DRAFT Reply LS on A New PRACH Cyclic Shift Restriction Set Nokia

The document was presented by Jari Lindholm from Nokia and states that the current high speed mode of PRACH can be enhanced to support higher UE speeds with a new restricted set of cyclic shifts for extra high speed cells as described in TR 36.878.
Discussion: According to the RAN plenary decision the required RAN1 specification changes will be done during 2nd half of 2016.
Decision: The document is noted.

Rel-14 WI on eMBMS enhancements for LTE

R1-162623 [Draft] LS on RAN plenary eMBMS enhancements for LTE Huawei, HiSilicon

The document was presented by Weiming Xiao from Huawei and is a follow-up to RAN#71 approval of Rel-14 WI on eMBMS enhancements for LTE [RP-160675], in which the following objective was included:

Specify means of using subframes 0, 4, 5, 9 (FS1) and 0, 1, 5, 6 (FS2) for MBSFN. (RAN2, RAN1)
The non-MBSFN subframes for unicast can only be used as Scell

RAN1 asks RAN to clarify the meaning of the above description" The non-MBSFN subframes for unicast can only be used as Scell". RAN1 understands it may be used to address the concern of backward compatibility, but still does not understand how this sub-bullet resolves the backward compatibility issue.
Discussion: Ericsson (rapporteur) is fine to delete "The non-MBSFN subframes for unicast can only be used as Scell" but can be done directly in RAN – no need to send an LS
Qualcomm→ let discuss in RAN1 and agree what to do.
Decision: The document is noted. Will be treated in the eMBMB session.

NR related

R1-163390 Characteristics of terrestrial IMT systems for frequency sharing / interference analysis in the frequency range between 24.25 GHz and 86 GHz RAN, NTT DOCOMO

The document was presented by RAN1 Chair and is a request for technical support and information relevant to the frequency range (24.25-86 GHz) from ITU-R WP5D group:

- provide the information on IMT-2020 system characteristics between 24.25 GHz and 86 GHz to be used in sharing and compatibility studies.
- WP 5D constraints are for
  - Initial system characteristics by October 2016 meeting of WP 5D
  - Final system characteristics by February 2017 meeting of WP 5D

Discussion: Coordination with RAN4 is needed.
Decision: The document is noted. Rapporteur shall take care of it.

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R1-163395 **LS on path loss accuracy and sensitivity in 5G channel modeling** **New York University Wireless**
The document was presented by RAN1 Chair on behalf of NYU WIRELESS - a multi-disciplinary academic research center at New York University in Brooklyn. Upon RAN chair's decision, the attached paper is made available in RAN1 and RAN as it is relevant for the RAN1 "Study on channel model for frequency spectrum above 6 GHz"
Discussion: Content shall be reviewed in channel model session.
Decision: The document is noted.

The following LS have been received during the course of the week:
R1-163685 **LS to RAN1 on RAN2 agreements related to V2V** **RAN2, Panasonic**
Decision: The document is treated under AI 7.3.2.
R1-163686 **LS on reviewing all LTE features up to Rel-13 for Category M1 UEs** **RAN2, NTT DOCOMO**
Decision: The document is treated under AI 7.1.5.
R1-163852 **LS on Power Headroom report** **RAN2, Huawei**
Decision: The document is treated under AI 7.2.1.

Postponed to next meeting.
R1-163896 LS on NB-IoT RRM requirements RAN2, Huawei

6 UTRA

R1-163610 **Chairpersons' summary of the UMTS sessions** **UMTS Session Chairpersons (Huawei, Ericsson)**
The document was presented by Carmela Cozzo from Huawei and Florent Munier from Ericsson.
Decision: The document is endorsed and content is incorporated as below.

6.1 Maintenance of UTRA Releases 4 – 13

6.1.1 FDD

R1-163197 **Clarification on measuring the transmitted code power for the downlink DPCH slot formats #17 and #18** **Ericsson**
Decision: The document is noted and CR0205 cat F to 25.215 (Rel-12) is agreed.
R1-163198 **Clarification on measuring the transmitted code power for the downlink DPCH slot formats #17 and #18** **Ericsson**
Decision: The document is noted and CR0206 cat A to 25.215 (Rel-13) is agreed.

6.1.2 TDD

None.

6.2 Multi-Carrier enhancements for UMTS - WID in RP-152290.

6.2.1 Performance evaluation

R1-162996 **Evaluation of 2+10 ms TTI configuration in DB-DC-HSUPA** **Huawei, HiSilicon**
Decision: The document is noted.
R1-162997 **Evaluation of 10+10 ms TTI configuration in DB-DC-HSUPA and DC-HSUPA** **Huawei, HiSilicon**
Decision: The document is noted.
R1-163192 **Evaluation of Multicarrier Enhancements for DC-HSUPA** **Ericsson**
Decision: The document is noted.
R1-163193 **Evaluation of Multicarrier Enhancements for DB-DC HSUPA** **Ericsson**
Decision: The document is noted.

Conclusions

- Continue evaluation using the link simulation setup used for the presented results
  - Expand the range of power values used in the two carriers:
    - Primary carrier: 0(no data) to 0.2W(no grant limit), with constant step size
  - Expand distance between UE and NodeB: 0 to 0.6Km (10m resolution)
  - Metrics:
    - DC
      - 10 vs. 2+2
      - 10+10 vs. 2+2
    - DB-DC (2+10 means 2ms in the lower band and 10ms in the higher band)
      - 2+10 vs. 2+2
      - 10+10 vs. 2+2
      - 10 vs. 2+2

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- Provide results showing with and without power limitation on the primary carrier
- Control channel overhead in DC and DB-DC cases is not considered.

6.2.2 Impact on current mechanisms

No contributions touching that topic.

6.2.3 Other

R1-162998 **TR 25.707 v0.1.1 on Multi-Carrier Enhancements for UMTS** **Huawei, HiSilicon**
Include text proposals agreed in RAN1#84
Decision: The document is endorsed as v0.2.0 in R1-163609 for future updates.
R1-163194 **Text proposal: Evaluation of Multicarrier Enhancements** **Ericsson**
Decision: The document is noted.

6.3 DTX/DRX enhancements in CELL_FACH - WID in RP-160601.

6.3.1 DRX improvements

R1-162239 **Further Discussions on HS-SCCH DRX lite proposal** **Qualcomm Europe Inc.(France)**
Decision: The document is noted.
R1-163195 **On the DRX enhancements in CELL_FACH** **Ericsson**
Decision: The document is noted.

Conclusion on DRX improvements
Qualcomm to double check:
- reduction in scheduling capability due to power sharing across HS-SCCH codes / scheduling instances
- redesign of the QC proposed solution in R1-162239 making sure both HS orders as well corresponding RX burst are within the same DRX cycle.
- Get back on re-using existing IEs for the purpose of 640ms proposal.

6.3.2 DTX improvements

R1-162240 **A dicussion note on EUL Inter-Arrival times in Cell Fach** **Qualcomm Europe Inc.(France)**
Decision: The document is noted.
R1-162999 **Evaluation of DTX in CELL_FACH** **Huawei, HiSilicon**
Decision: The document is noted.
R1-163000 **DTX design in CELL_FACH** **Huawei, HiSilicon**
Decision: The document is noted.
R1-163196 **On evaluating the implicit release of common E-DCH resources in CELL_FACH** **Ericsson**
Decision: The document is noted.

Conclusions on DTX improvements:
According to the CELL FACH traffic model studied during this work item, it was found that longer timers are impacting the cell capacity and the average blocking more significantly than shorter timers.

Evaluation will continue. Future simulations will include (but are not limited to) shorter timers (less than 80ms).
It is foreseen that DTX can provide gains in two scenarios:
- DTX during inactivity timer (i.e. prior to timer expiration)
- DTX during the time interval prior to retransmission

7 E-UTRA

7.1 Maintenance of E-UTRA Releases 8 – 13

R1-163837 **Chairman's Notes of Agenda Item 7.1 on Maintenance of E-UTRA Releases 8 - 13** **Session Chairman (Nokia)**
The document was presented by Matthew Baker from Nokia and .provides the outcomes of the remaining maintenance issues (except eMTC)
Decision: The document is endorsed and the content incorporated below.

7.1.1 Maintenance of E-UTRA Release 8 – 12

None.

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7.1.2 Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers

R1-163200 Coding of higher layer parameter codebooksizeDetermination-r13 Nokia, Alcatel-Lucent iShanghai Bell

- *codebooksizeDetermination-r13 = 0* is replaced with *codebooksizeDetermination-r13 = dai* and *codebooksizeDetermination-r13 = 1* is replaced with *codebooksizeDetermination-r13 = cc*.

Decision: The document is noted and CR0197 to 36.212 is agreed in R1-163421.

R1-163201 Coding of higher layer parameter codebooksizeDetermination-r13 Nokia, Alcatel-Lucent Shanghai Bell

Decision: The document is noted and CR0622 to 36.213 is agreed in R1-163422.

R1-162104 Discussion on HARQ-ACK ordering in case of semi-static codebook configuration for eCA Huawei, HiSilicon

The document was presented by Yongxia Lyu from Huawei.

- Observation 1: HARQ-ACK bit ordering with Alternative 2 follows the Rel-12 principle but a new bit ordering is used with Alternative 1.
- Observation 2: HARQ-ACK bit for DL SPS PDSCH without corresponding PDCCH/EPDCCH is captured with Alternative 2 but is omitted with Alternative 1.
- Observation 3: There is no substantial difference of HARQ-ACK feedback performance between Alternative 1 and Alternative 2.
- Proposal 1: For FDD, the description of semi-static HARQ-ACK codebook determination for PUCCH format 4/5 in TS 36.213 is removed and that in TS 36.212 is kept.
- Proposal 2: For TDD, the pseudo code for semi-static HARQ-ACK codebook determination in TS 36.213 is removed and the parameters $o_{c,l}^{ACK}$ and B_c^{DL} are defined for PUCCH format 4/5 in TS 36.213.

Discussion: CR is in R1-162142.
Decision: The document is noted.

R1-162142 Correction on HARQ-ACK ordering in case of semi-static codebook configuration of eCA in 36.213 Huawei, HiSilicon Rel-13 36.213 - CR0608 F

Decision: The document is noted. It is agreed in principle to use the pseudo code in 36.212 and remove the corresponding part in 36.213. Continue offline discussion – (Huawei)

Monday evening

R1-163514 Correction on HARQ-ACK ordering in case of semi-static codebook configuration of eCA Huawei, HiSilicon Rel-13 36.213 - CR0608r1 F

Decision: The document is agreed.

R1-162105 Discussion on SPS HARQ-ACK bit handling in case of dynamic codebook configuration for eCA Huawei, HiSilicon

The document was presented by Fredrik Berggren from Huawei.

Proposal. If the misalignment of HARQ-ACK codebook size between the eNodeB and the UE for the case the SPS PDSCH is not received should be avoided, consider to always append the SPS HARQ-ACK bit for all subframes that are activated for SPS transmission.

Discussion: CR is in R1-162143.
Decision: The document is noted.

R1-162143 Correction on SPS HARQ-ACK bit handling in case of dynamic codebook configuration of eCA in 36.213 Huawei, HiSilicon, Samsung, Lenovo Rel-13 36.213 - CR0575r1 F

Decision: The document is noted. Continue offline discussion – (Huawei)

R1-163416 Corrections on HARQ-ACK generation for eCA in 36.213 CATT (R1-162253)

The document was presented by Fang Chen Cheng from CATT.

Discussion: Huawei→ concern can be taken into account in a revision of R1-162143.
Decision: The document is noted.

Monday evening

R1-163500 Correction on SPS HARQ-ACK bit handling in case of dynamic codebook configuration of eCA in 36.213 Huawei, HiSilicon, Samsung, Nokia, Fujitsu, CATT Rel-13 36.213 - CR0575r2 F

Decision: The document is agreed.

R1-162751 Correction on reporting mode 1-0 and 1-1 for aperiodic CSI of eCA in 36.212 Huawei, HiSilicon

The document (CR0193 to 36.212) was presented by Yongxia Lyu from Huawei.

- Modify the description of "Channel quality information formats for wideband CQI reports" in section 5.2.2.6.1 to be aligned with the section 7.2.1 of 36.213.

Discussion: DraftCR is in R1-162106. Ericsson's alternative is in R1-163089.

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Decision: The document is noted.
R1-162106 **Alternative correction on reporting mode 1-0 and 1-1 for aperiodic CSI of eCA in 36.212 Huawei, HiSilicon**
Decision: The document is noted.

R1-163089 **Correction on aperiodic CSI reporting mode 1-0 and 1-1 Ericsson Rel 13 36.212 - CR0194 F**
Discussion: Also supported by Intel, CATT, ZTE
Huawei won't object – is fine to follow the majority
Decision: The document is agreed.
R1-163090 **Correction on aperiodic CSI reporting mode 1-0 and 1-1 Ericsson Rel 13 36.213 - CR0615 F**
Decision: The document is agreed.

R1-162254 **Corrections on n_HARQ-ACK calculation for PUCCH format 4/5 in 36.213 CATT**
Decision: The document is noted. Continue offline discussion – (CATT)

R1-162256 **Corrections on Simultaneous HARQ-ACK and P-CSI in 36.213 CATT**
- Describe UE behavior for HARQ-ACK and P-CSI multiplexing when falls back to Rel-12 behavor.

Decision: The document is noted and CR0623 to 36.213 is agreed in R1-163433.
Further revised and agreed in R1-163526 (CR623 Rev. 1).

R1-162258 **Clarification on PUCCH format 4/5 resource derivation in 36.213 CATT**
Discussion: Huawei→ point on UE behaviour is not needed
Decision: The document is noted. Continue offline discussion – (CATT)

R1-162422 **Clarification on Simultaneous transmission of HARQ-ACK and SR in 36.213 CATT**
Discussion: LGE→ don't support the need for separate descriptions for PUCCH format 4/5 with dynamic HARQ-ACK codebook and fixed HARQ-ACK codebook
Decision: The document is noted. Continue offline discussion – (CATT)
R1-163507 **Clarification on Simultaneous transmission of HARQ-ACK and SR in 36.213 CATT, LGE**
Decision: The document is noted.
R1-163530 **Corrections on simultaneous transmission of HARQ-ACK and SR in 36.213 CATT, LGE, Nokia**
Decision: The document is noted and agreed as CR0632 to 36.213 in R1-163533.

R1-163334 **Discussion on the motivation to capture the timing for secondary cell activation / deactivation for eCA in 36.213 Huawei, HiSilicon**
The document was presented by Yongxia Lyu from Huawei.
- Proposal 1: It is necessary to specify UE CSI report action explicitly if PUCCH SCell is not active in subframe n+8
- Proposal 2: It is necessary to specify the CSI timing requirement of subframe n+8 shall only be applied on the CSI reporting on an activated serving cell.

Discussion: What the UE should do does already exist in the spec.
Decision: The document is noted.
R1-162727 **Correction on timing for secondary cell activation / deactivation for eCA in 36.213 Huawei, HiSilicon Rel-13 36.213 - CR0610 F**
- Add the related description to capture the timing agreements for PUCCH SCell activation/deactivation.

Decision: The document is noted. Continue offline discussion until Wednesday – (Huawei)
R1-163458 **Correction on timing for secondary cell activation / deactivation for eCA in 36.213 Huawei, HiSilicon Rel-13 36.213 CR0610r1 F**
Decision: The document is agreed.

R1-162645 **Remaining Issue on HARQ-ACK Codebook Determination Samsung**
The document was presented by Aris Papasakellariou from Samsung.
Proposal: For TDD, HARQ-ACK codebook size in the PUSCH is determined as for FDD.
Discussion: Remaining Issues on HARQ-ACK Codebook Determination are proposed in following 2 CRs.
Decision: The document is noted.
R1-162646 **Draft CR on Correction for DAI Presence for eCASamsung**
Decision: The document is noted. Continue offline discussion until Wednesday – (Samsung)
R1-163626 **Correction on DAI Presence in DCI formats for eCA Samsung, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic Rel-13 36.212 CR201 F**
Decision: The document is agreed.

R1-162647 **Draft CR on Correction for HARQ-ACK Codebook Determination in eCA Samsung**

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Decision: The document is noted. Continue offline discussion until Wednesday – (Samsung)
R1-163527 **CR on Correction for HARQ-ACK Codebook Determination in eCA** **Samsung** **Rel-13 36.213 CR0630 F**
Decision: The document is agreed.

7.1.3 Maintenance of Release 13 licensed-assisted access to unlicensed spectrum

Channel access
R1-162449 **Discussion on contention window adjustment procedure** **LG Electronics**
The document suggests a TP to apply to the contention window adjustment procedure
Decision: The document is noted.
R1-162450 Correction on contention window adjustment procedure LG Electronics
R1-163752 Draft CR on CWp adjustment Qualcomm Incorporated

R1-162847 **Draft CR for handling DTX,NACK/DTX,any state in HARQ feedback for LAA multi-carrier operation BROADCOM LIMITED**
Clarify how DTX, NACK/DTX, any states for TBs sent on the unlicensed channel are handled for the purpose of caluculating the percentage of ACK values in the reference subframe
Decision: The document is noted.

R1-162917 **Draft CR for the contention window adjustment procedure in LAA downlink channel access Nokia, Alcatel-Lucent Shanghai Bell**
For the definition of "reference subframe", the phrase "for which HARQ-ACK feedback is available" is changed to "for which at least some HARQ-ACK
Decision: The document is noted. Continue offline discussion until Wednesday – (Nokia)
Revised in R1-163462 **Draft CR for the contention window adjustment procedure in LAA downlink channel access Huawei, HiSilicon**
Decision: The document is noted.
Revised in R1-163756 **Draft CR for the contention window adjustment procedure in LAA downlink channel access Huawei, HiSilicon, LGE, WILUS, Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
Revised in **R1-163681** **Draft CR for the contention window adjustment procedure in LAA downlink channel access Huawei, HiSilicon, LGE, WILUS, Nokia, Alcatel-Lucent Shanghai Bell, Broadcom**
Decision: The document is noted and agreed as CR0651 to 36.213 in R1-163831.

R1-162853 **Discussion on slot misalignment between LAA and Wi-Fi BROADCOM LIMITED**
Observation 1: Misalignment of slot boundaries across different technologies can cause significant impact to performance.
Observation 2: The impact of slot misalignment decreases as the CCA duration within a CCA slot is increased from 4us.
Observation 3: Change in T_{sl} and T_f from the specified values of 9us and 16us respectively will prevent any mechanism implemented in future to align slot boundaries across technologies.
Proposal 1: 3GPP shall consider enhancing LAA LBT in one of the following ways:
- *LAA requires a mechanism by which an LAA eNB accurately time aligns its channel access slots with those of coexisting IEEE 802.11 devices. One means to do so is to detect and transmit the 802.11 PHY preamble.*
- *Alternatively, in the case of LAA LBT that is capable only of energy detection, LAA LBT procedure reduces the transmission burst ending position detection error by requiring a larger CCA period Xμs (X > 4, e.g. X=7) in each CCA slot, and requires detection results to be reported every 1μs during each CCA period*

Proposal 2: LAA should conform to the CCA slot length of 9us exactly and it should exactly comply with the durations 9us and 16us for T_{sl} and T_f respectively.

Discussion: Broadcom has concern changing the durations, also expressed when informing RAN4 via LS from last meeting.
Ericsson→ LS was agreed by RAN1, not by a few companies.
No consensus on the proposed technical enhancements → Mr Chair suggested to continue offline.
Broadcomm would like the slot misalignment issue being evaluated and considered by other companies. Can RAN1 agree that there is an issue?
Mr Chair→ technical solutions need to be reconsidered.
Decision: The document is noted. No consensus, continue offline discussion until Wednesday – (Broadcom)
Wednesday: Still no consensus, continue discussion until the next meeting

R1-162855 **Further Discussion on LAA DL Multi-Channel Access Coexistence Issues BROADCOM LIMITED**
Observation 1: LAA lacks the similar channel frequency planning rules that are used by the 802.11ac devices for the channel bandwidth larger than 20 MHz in 5 GHz band. That means LAA eNB can use any multi-channel combination within 5 GHz band for the channel access, which is not necessarily aligned with 802.11ac multi-channel positions defined by IEEE.

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Observation 2: In general, the Wi-Fi network performance is degraded when it coexists with the LAA network that uses the flexible channel grouping than when it coexists with the LAA network that uses the 802.11 channel grouping.
Observation 3: Using the self-deferral or not in the LAA multi-channel access can impact the Wi-Fi network coexistence performance.
Proposal 1: In the case of LAA operation using up to four 20 MHz channels in unlicensed band, those channels shall reside in a single specified 80 MHz channel group aligned with IEEE 802.11.
Discussion: Qualcomm→ all the points raised in this contribution have been already considered in recent past before agreeing coexistence decisions (RAN1#83). No need to reopen the discussion.
Ericsson→ better to wait for the outcomes of the current discussions in ETSI BRAN.
Mr Chair→ this was already discussed in previous RAN1 meetings, currently under discussion in ETSI BRAN – doesn't really see the need for 3GPP to continue the discussion.
Decision: The document is noted. No consensus.

R1-162856 Draft CR for pausing of random backoff counter for LAA multi-carrier operation BROADCOM LIMITED
Clarify that the random backoff counter is paused for all the channels which are not selected for transmission while the eNB is transmitting on a set of channels
Discussion: .
Decision: The document is noted. Continue offline discussion until Wednesday – (Broadcom)
Wednesday: Prepare a draft CR in R1-163459 – revisit on Thursday – (Broadcom).
Conclusion: Continue discussion until the next meeting

R1-162451 Correction to the usage of undefined terminology "channel" LG Electronics
Decision: The document is noted and agreed as CR0625 to 36.213 in R1-163435.

R1-163296 Clarification on channel access procedure after an additional defer duration for DL LBT WILUS Inc.
Discussion: .
Decision: The document is noted. TP is agreed in principle and CR shall be prepared accordingly in R1-163436 (CR0626 to 36.213). Later on Monday, R1-163436 is agreed.

R1-163386 CR on Freezing ECCA counter during LBT for DRS Qualcomm Inc.
Discussion: LGE→ current spec is ok.
Decision: The document is noted. Continue offline discussion – (Qualcomm)
Conclusion: Proposed CR is not pursued.

Partial subframe
R1-162133 Discussion on the support of DwPTS in partial ending subframes Huawei, HiSilicon, Samsung, CATT
The document was presented by Xia Yuan from Huawei.

- Proposal 1: Reuse the following existing FS2 DwPTS functionalities to the partial ending subframe on LAA Scell.
  - Duration of PDCCH up to 2 symbols in DwPTS
  - ECCE size determination in DwPTS
  - DMRS pattern in DwPTS
  - EPDCCH monitoring in DwPTS
  - TBS determination for PDSCH transmitted in DwPTS
- Proposal 2: there is no PSS in the third OFDM symbol for the partial ending subframe and the following data/control transmission can be supported by the central 6 PRBs.

Condition		Type of data transmission supported by the central 6 PRBs
The partial ending subframe is not subframe 0 or 5		CRS and DMRS Based PDSCH transmission; EPDCCH transmission
The partial ending subframe is subframe 0 or 5	The duration of the partial ending subframe is less than 12 OS	
	The duration of the partial ending subframe is 12 OS, (FS1 PSS/SSS is transmitted)	CRS based PDSCH transmission

- Proposal 3: PSS/SSS is transmitted in the partial ending subframe following frame structure type 1 when the subframe duration is 12 OFDM symbols.

Decision: The document is noted.

R1-162914 CR Discussion for Ending Partial Subframe in LAA Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted. Nokia is fine to follow R1-162133
R1-162915 Draft CR for 36.211 on the support of ending partial subframe in LAA Nokia, Alcatel-Lucent Shanghai Bell
R1-162916 Draft CR for 36.213 on TBS determination for ending partial subframe in LAA Nokia, Alcatel-Lucent Shanghai Bell

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R1-163164 Clarification on subframe structure for ending partial subframe in 36.211 Samsung

R1-162638 Clarification on "special subframe" for frame structure type 3 in 36.213 Huawei, HiSilicon, Samsung, CATT
Decision: The document is noted.

R1-163525 Clarification on "special subframe" for frame structure type 3 in 36.213 Huawei, HiSilicon, Samsung, CATT, Nokia, Alcatel-Lucent Shanghai Bell, Ericsson, Qualcomm
Decision: The document is noted and agreed in R1-163531 as CR0631 to 36.213.
R1-163521 Draft CR for 36.211 on the support of ending partial subframe in LAA Nokia, Alcatel-Lucent Shanghai Bell, CATT, Ericsson, Samsung, Huawei, HiSilicon
Decision: The document is noted and agreed in R1-163528 as CR0235 to 36.211.

R1-163205 Modulation Order Determination for Downlink Partial Subframes Panasonic
The document was presented by Alex Golitschek from Panasonic.

- Observation 1: For a UE configured to use up to 64-QAM, when increasing the modulation level for MCS levels 7-9 & 13-16, 5 additional choices for MCS/TBS are available. For well-positioned UEs, the corresponding throughput gain for partial subframes has been observed in simulations to exceed 10%.
- Observation 2: For a UE configured to use up to 256-QAM, in a partial subframe 256-QAM cannot be currently assigned if the UE should attempt to decode the packet.
- Observation 3: For a UE configured to use up to 256-QAM, when increasing the modulation level, 256-QAM can be assigned and a peak throughput gain of 33.5% is observed.
- Proposal: Specify that for an initial partial subframe, the UE uses the proposed tables to determine the modulation order and the TBS (where existing tables are applied for I_{MCS})

Decision: The document is noted.
R1-163367 MCS Tables for Initial Partial TTI in LAA Ericsson
The document was presented by Havish Koorapaty from Ericsson.

- Proposal 1 If new MCS tables are to be introduced for DL initial partial TTIs, the designs should be carefully optimized for high link and system performance.
- Proposal 2 New MCS tables for DL initial partial TTI are proposed.

Discussion: Panasonic believes that Ericsson's proposal performs better while Panasonic's proposal is simpler to implement→ matter of preference which one to choose but both are OK.
Nokia supports Ericsson's MCS table.
Panasonic ok to follow the Ericsson proposal – would like to work out the CR wordings
Decision: The document is noted.

R1-163206 MCS/TBS Determination for initial partial DL subframes Panasonic
R1-163368 MCS Tables for Initial Partial TTI in LAA Ericsson
Decision: The document is noted. Further revised in:
R1-163508 MCS Table for Initial Partial TTI in LAA Ericsson, Panasonic
Decision: The document is agreed as CR0628 to 36.213.

RRM measurement
R1-162134 Discussion on the support of 2CRS ports in DRS for LAA Huawei, HiSilicon
Decision: The document is noted.
R1-162235 Discussion on the number of CRS ports in DRS Qualcomm Inc.
Decision: The document is noted.
R1-162637 Clarification on CRS antenna port number in DRS in 36.211 Huawei, HiSilicon
Continue offline discussion until Wednesday – (Huawei, Qualcomm)
Wednesday
R1-162236 Draft CR on UE assumptions of number of CRS ports in DRS Qualcomm Inc.
Decision: The document is noted. Continue offline discussion – (Qualcomm) – revisit after Thur am coffee break
Thursday
R1-163461 Clarification on UE assumptions on the number of CRS ports in the DRS Qualcomm Inc.
Decision: The document is noted. Agreed as CR0648 to 36.213 in R1-163680.
Send LS to RAN4 to inform them of the agreement of this CR, also indicating that RAN1 does not intend this to impact RAN4 requirements.
Friday
R1-163682 [DRAFT] LS on PUSCH transmission for eLAA Qualcomm
Decision: The document is noted and final LS is agreed in R1-163928.

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Others

R1-163002 **Draft CR on clarification for LAA CSI processing Qualcomm Incorporated**

The document was presented by Srinivas Yerramalli from Qualcomm.

- Add a condition on the subframe configuration being set to a valid value for the subframe to be used for CSI measurements.

Decision: The document is noted. Agreed as CR0627 to 36.213 in R1-163501.

R1-162135 **Draft CR on search space definition for LAA DL partial subframes in 36.213** **Huawei, HiSilicon**

The document was presented by Xia Yuan from Huawei.

- Clarify that when the UE is not configured with 's07', the UE would not monitor the PDCCH common search space.

Decision: The document is noted. Continue offline discussion until Wednesday – (Huawei)

Wednesday: Consensus that CR is not needed.

R1-163384 **CR on applicability of DL procedures to LAA** **Qualcomm Inc.**

The document was presented by Srinivas Yerramalli from Qualcomm.

Decision: The document is noted. Agreed as CR0200 to 36.212 in R1-163532.

R1-163385 **CR on correction to EPDCCH procedures to FS3** **Qualcomm Inc.**

The document was presented by Srinivas Yerramalli from Qualcomm.

Decision: The document is noted. Agreed as CR0232 to 36.211 in R1-163502.

MCC post meeting: note that CR number in cover sheet should be read as CR0232 – not CR0200 – and correction will apply before submission to plenary.

R1-163420 **Draft CR for 36.213 on multi-channel access procedure in LAA** **Nokia, Alcatel-Lucent Shanghai Bell**

The document was presented by Sigen Ye from Nokia.

Decision: The document is noted. Continue offline discussion until Wednesday – (Nokia)

Wednesday: Change to 15.1.5.1.1 is agreed in principle – updated in R1-163684 – agreed as CR0645 to 36.213 in R1-163672

Continue offline discussion – revisit on Thursday – (Nokia) – recommendation of Session Chair to RAN1 Chairman will be to proceed with a Working Agreement if the situation is unchanged.

Conclusion: The existence of multiple groups of channels is already agreed.

Ericsson noted that Broadcom participated in RAN1#83 and did not object to the agreement that mentions "a group carriers", and participated in subsequent email discussion.

Broadcom states that they had a different interpretation of the agreement.

Broadcom stated that multiple groups without restrictions are not allowed.

Broadcom subsequently stated that their view is that multiple groups are not allowed.

Broadcom states that "*the* number of carriers" implies that there is only one group.

Broadcom is invited to submit a CR indicating their proposed restrictions for discussion - R1-163460.

Thursday

New (compromise) proposal in **R1-163671 Draft CR for 36.213 on multi-channel access procedure in LAA Nokia, Alcatel-Lucent Shanghai Bell**

Decision: The document is noted – companies are invited to check and discuss this offline until Friday – revisit on Friday.

Friday: Continue discussion until the next meeting

R1-163431 **Draft CR for 36.212 on subframe configuration for LAA** **Nokia, Alcatel-Lucent Shanghai Bell**

The document was presented by Sigen Ye from Nokia.

Decision: The document is noted. Agreed as CR0198 to 36.212 in R1-163503.

Friday

R1-163925 **Initial CCA Behaviour in the Channel Access Procedure** **Ericsson**

Decision: The document is noted and CR0649 to 36.213 is agreed.

R1-163927 **Draft CR on clarification for channel sensing** **Qualcomm**

Decision: The document is noted and CR0650 to 36.213 is agreed.

R1-163786 **[Draft] LS on DRS Duty Cycle** **Qualcomm**

Decision: The document is noted and final LS is agreed in R1-163931

7.1.4 Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE

CSI-RS

R1-162435 **Clarification of CSI-RS on extended CP** **NEC**

- Changed UE behavior to restrict CSI-RS transmission in DwPTS for extended CP.

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- Changed the table 6.10.5.2-2 and the table title to support normal subframe only.

Decision: The document is noted, revised in **R1-163522** and agreed as CR0236 to 36.211 in:

R1-163534 **Clarification on CSI-RS for estended CP NEC, Samsung, CATT**

R1-162436 **Clarification on PDSCH mapping to resource elements NEC**

Decision: The document is noted. Agreed as CR0233 to 36.211 in R1-163504.

R1-162652 **Draft CR on CSI-RS description in TS 36.211 Samsung**

Decision: The document is noted. Agreed as CR0234 to 36.211 in R1-163505 assuming the following:

- ~~up to twenty four~~one or more configurations for CSI reporting for which the UE shall assume non-zero transmission power for the CSI-RS, and

SRS

R1-163075 **Correction on the description about UpPTS length for premable format 4 of PRACH ZTE**

- In section 5.7.1, the UpPTS length for preamble format 4 for PRACH is further cleared that the legacy UpPTS symbols still can be used for PRACH preamble format 4 as long as the length of legacy UpPTS is $4384 \cdot T_s$ and $5120 \cdot T_s$

Decision: The document is noted. Agreed as CR0237 to 36.211 in R1-163535.

DM-RS

R1-162447 **Correction on the description of DMRS table ZTE**

Decision: The document is noted. Agreed as CR0199 to 36.212 in R1-163506.

R1-163076 **Correction on the description about DMRS ZTE**

- Clarify the condition when port={11,13} is used for transmission
- Fix the description of using DMRS ports for PDSCH transmission and DMRS sequence generation.

Decision: The document is noted, revised in **R1-163819** and agreed in R1-163673 (CR0242 to 36.211) with original formula shown as strickthrough.

R1-163122 **Correction on UE assumption on DMRS ports ZTE**

- Clarify UE assumption in case of the new DMRS table in DCI formats 2C and 2D is configured for single-antenna port transmission scheme.

Decision: The document is noted. Revised in **R1-163688**.

R1-163082 **Clarification of OCC=2 and OCC=4 DMRS MU-MIMO Transmission Ericsson**

The document was presented by Mark Harrisson from Ericsson.

- A UE can use a simpler E-MMSE-IRC receiver while providing higher capacity via 3 MU-MIMO layers than if the UE only uses R-ML with two MU-MIMO layers.
  - Mixed OCC=2 and OCC=4 need not affect E-MMSE-IRC receivers when they use OCC=2 to estimate coscheduled interference.
  - The UE is free to use R-ML or E-MMSE-IRC according to channel conditions and implementation with mixed OCC=2 and OCC=4.
- The current specification does not identify UE behavior for 2 layer MU-MIMO transmission with OCC=2, and so requires correction.
- In order to not prevent eNB from multiplexing Rel-13 UEs with OCC=2 and OCC=4 as agreed, it is necessary to specify UE behaviour when port 7 is coscheduled with ports 8,13 and when port 8 is coscheduled with ports 7,11.

Discussion: CR is in R1-163085..

Decision: The document is noted.

R1-163085 **MU-MIMO with Mixed Orthogonal Cover Code Length Ericsson**

Decision: The document (CR0613 to 36.213) is noted. CR0613 is postponed according to the conclusion below:

Conclusion: Views from UE vendors are invited until RAN1#85 – revisit at RAN1#85.

Class A feedback (including codebook)

R1-162649 **Rationale for draft CR on FD-MIMO codebooks (36.213) Samsung**

Decision: The document is noted.

R1-162650 **Draft CR on FD-MIMO codebooks (36.213) Samsung**

Discussion: Supported by Samsung, Ericsson, CATT, NTT DOCOMO, AT&T, Deutsch Telecom, KDDI, China Telecom, Nokia Networks, NEC, KT Corporation, ETRI, Mitsubish Electric, National Instruments, Sprint

Objected by Huawei, HiSilicon

Decision: The document is noted. Continue offline.

Conlusion: There is no consensus in RAN1.

R1-162655 **Clarification on periodic CSI reporting for class A in TS 36.213 Samsung**

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- Observation: The parameter H' in PUCCH mode 1-1 cannot be configured since current specification does not support simultaneous configuration of 'widebandCQI' and 'subbandCQI'.
- Proposal: RAN1 should discuss and decide a way to configure H'.

Discussion: Samsung suggested the following 3 alternatives:
Alt 1: send LS to RAN2 to resolve the issue - supported by NEC
Alt 2: Fix H' to 2 - No support
Alt 3: Define the relationship between M_{RI} and H' (Samsung preferred solution)
Qualcomm would like to use RRC reconfiguation without having new RRC configuration(s) – Alt 4 – also supported by LGE
Decision: The document is noted. Prepare a draft LS (R1-163512) to RAN2 asking them to solve the issue - (Samsung)
R1-163512 [Draft] LS on signalling of periodic CSI reporting for class A Samsung
Decision: The document is noted and final LS is agreed in R1-163668.

R1-163091 Correction to S1 and S2 definition and i2 bit width Ericsson
Decision: The document is noted and CR0195 to 36.212 is agreed.

Class B feedback
R1-162651 Draft CR on missing CRI-only table (36.212) Samsung

- Add payload table for CRI-only reporting in section 5.2.2.6.1 and clarification in section 5.2.2.6.2

Discussion: .Huawei has detected a potential overlapping issue with already agreed CR from last meeting.
Decision: The document is noted. Continue offline.
Revised in **R1-163660** and agreed as CR0203 to 36.212 in R1-163796, removing changes on cover page, changes-on-changes, and adding CR number.

R1-162653 Clarification on non-PMI based CSI reporting in TS 36.213 Samsung
Proposal 1: The conditions for non-PMI reporting mode for 'CLASS B' eMIMO-Type in PUCCH reporting should be correctly captured in the current specification.
Observation: Two options for UE assumption on precoding matrix for PUSCH mode 3-0/PUCCH mode 2-0 are available.

- *Alternative 1: Remove all assumptions on precoding matrix in non-PMI based CSI reporting mode descriptions.*
- *Alternative 2: Release the assumption that 'a single precoding matrix is selected from the CBSR' and clarify that 'for each subband a preferred precoding matrix is selected from the codebook subset assuming transmission only in the subband' in non-PMI based CSI reporting mode descriptions.*

Proposal 2: Support both options in observation 2 and revise the corresponding descriptions in the current specification.
Decision: The document is noted.
R1-162654 Draft CR on non-PMI based CSI reporting in TS 36.213 Samsung
Decision: The document is noted. Continue discussion until RAN1#85.

R1-162453 Correction on the linkage between CSI-RS and CSI-IM for Class B LG Electronics

- Capture the agreed description on one to one linkage between the IDs in NZP-CSI-RS-ID-List and CSI-IM-List, and the other associated parameters on *p-C-AndCBSR-PerResourceConfigList* and *alternativeCodebookEnabledFor4TXProc*.

Decision: The document is noted. Agreed as CR0629 to 36.213 in R1-163513.

R1-162656 Clarification on CRI reporting Samsung
The document was presented by Youngwoo Kwak from Samsung.

- Proposal 1: Usage of CSI-RS ID for class B in TM9 should be clarified.
- Proposal 2: Clarify linkages Linkages between CSI-RS, CSI-IM, alternative 4Tx codebook, P_C and CBSR.

Decision: The document is noted. Proposal 1 agreed – prepare CR accordingly.
Wednesday
R1-163687 Draft CR on CSI-RS ID configuration for TM9 in 36.213 Samsung
Decision: The document is noted and agreed as CR0647 to 36.213 in R1-163670 with ME+RAN boxes checked on cover page.

Codebook (Rank 5 – 8)
R1-162343 Further evaluation on Rank 5-8 Codebook ZTE
Proposal 1: Adopt the proposed codebook which reuses legacy 8Tx codebook as Rel-13 rank 5-8 codebook.
Decision: The document is noted.
R1-162452 Discussions on rank 5-8 codebookLG Electronics
Proposal 1. Adopt rank 5-8 codebook in [R1-157461] (this option allows W_2 feedback for rank 5-8) for Rel-13 FD-MIMO.
Decision: The document is noted.
R1-162967 Evaluation of Rel. 13 rank 5-8 codebook NTT DOCOMO

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Observation: Rank 5-8 codebooks in Scheme 1 and Scheme 2 have similar performance. Scheme 3 suffers from obvious performance degradation.
Proposal: Confirm the working assumption on rank 5~8 codebook.
Decision: The document is noted.

R1-163087 **Rank 5-8 Class A FD-MIMO Codebook Alternatives and Performance** **Ericsson**
Observations:
- *A 24% increase in transmissions involving ranks 5-8 is observed in 3D-UMi with the 16-port rank 5-8 codebooks when compared to the Rel-10 8-port rank 5-8 codebooks.*
- *A 32% increase in transmissions involving ranks 5-8 is observed in 3D-UMi with the 16-port rank 5-8 codebooks when compared to the Rel-10 8-port rank 5-8 codebooks.*
- *The 16-port ranks 5-8 codebooks yields 3.5% to 6.3% mean user throughput over the alternative 8-port ranks 5-8 codebooks.*

Proposal: The current Rel-13 codebooks for CLASS A rank 5 to 8 should be kept.
Decision: The document is noted.

R1-163136 **Simulation Results of RAN 5-8 Codebook Beijing Xinwei Telecom Techn.**
Observation 1: In the system level simulation, the percentage of UE with rank greater than or equal to 5 is less than 5%. Thus it is fairer to compare rank 5-8 codebook performance through link level simulation, in which rank 5-8 percentage would very high under high SNR.
Observation 2: Even for link level simulation where there are more UEs with rank greater than 5, R13 FD-MIMO codebook still has limited gains compared to R10 codebook.
Decision: The document is noted. Further revised in R1-163415.

Alt.1: rank 5-8 code book as captured in 157789 is supported (confirm the WA)
Alt 2: rank 5-8 code book as captured in 162343 is supported (ZTE)
Alt 3: rank 5-8 code book as captured 157461 is supported (LGE)

Possible conclusions
1: If RAN1 cannot reach a consensus until wed, then rank 5-8 class A codebooks are not supported in Rel-13
2: No new Rank 5-8 class A codebook (i.e above Alt 2 and 3) is introduced in Rel-13
3: RAN1 cannot find critical issues for existing WA about Rank 5-8 codebook
Still ZTE had concern about the above conclusion 3 – ZTE objected
Mr Chair, 3 companies having concern with conclusion 1, 2 companies having concern with conclusion 2 – let's agree on conclusion 3
For the sake of making progress, ZTE agreed to the conclusion 3 but asked to note that their concern is on additional complexity of the rank 5-8 codebook without providing any performance gains

Conclusion:
- RAN1 can not find critical issues for existing WA about rank 5 – 8 codebooks

R1-163088 Discussion on Correction to Rank 5-8 Operation in Class A Config 1 Ericsson
R1-163086 **Correction to rank 5-8 FD-MIMO CSI feedback** **Ericsson**
Decision: The document is noted and CR0614 to 36.213 is agreed.

Others
R1-162344 **Remaining issues on CSI processing relaxation** **ZTE**
Decision: The document is noted. Continue discussion until RAN1#85.

7.1.5 Maintenance of Release 13 further LTE physical layer enhancements for MTC

R1-163891 **Chairman's Notes of Agenda Item 7.1.5 on eMTC CRs** **Ad-hoc chair (Qualcomm)**
The document was presented by Wanshi Chen from Qualcomm and .provides the outcomes of the remaining maintenance issues related to eMTC.
Decision: The document is endorsed.

R1-163768 LS on PRACH preamble power for eMTC Ericsson
The LS is endorsed. The final LS is agreed in R1-163791

R1-163686 LS on reviewing all LTE features up to Rel-13 for Category M1 UEs RAN2
R1-163749 Reply LS on RAN2 review of all LTE features up to Rel-13 for Category M1 UEs Ericsson
R1-163913 [Draft] Reply LS on RAN2 review of all LTE features up to Rel-13 for Category M1 UEsEricsson

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The draft reply LS is for email approval till 4/20/2016 – Johan (Ericsson)

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

Collision Handling
R1-162456 Correction on collision of dynamically scheduled data and semi-statically scheduled data for Rel-13 eMTC LG Electronics
Decision: The document is noted.
Conclusion: The CR in R1-162456 is agreed in principle by adding "Half-duplex". Also discuss further offline whether TA has impact on subframe definitions between DL and UL.
Prepare final CR, to be visited later this week.
R1-163783. The CR is agreed in R1-163787, with the following update: "overlaps partially or fully → collides partially or fully"

R1-163811 Collision between PUCCH format 2 and PDSCH with repetitions Qualcomm

R1-162659 Clarification on MPDCCH/PDSCH Collision with PSS/SSS/PBCH Samsung
Decision: The document is noted.
R1-163353 Collision between PSS/SSS and MPDCCH/PDSCH for MTC Ericsson
Decision: The document is noted.
R1-163352 Collision between PBCH and MPDCCH for MTC Ericsson
Decision: The document is noted.
Proposed Conclusion:
- For an M-PDCCH candidate, if colliding with PSS/SSS (even partially), it is dropped in the given subframe
- For a DM-RS based PDSCH transmission, for the REs colliding with PSS/SSS, the REs are punctured by PSS/SSS
- For CRS based PDSCH, if colliding with PSS/SSS, Alt 2 in R1-162659 is agreed
- Prepare a CR, to be visited later this week

Further discussion offline – Aris/Yufei (also include discussion on collision between M-PDCCH and PBCH)
The corresponding CR agreed in principle in **R1-163661.** Correct a typo in the doc and agreed in R1-163790
Email approval about R1-163817 until 21st April – Johan (Ericsson)

R1-162594 On the collision between eMTC SIB and MPDCCH/PDSCH in TS 36.213 Huawei, HiSilicon
Decision: The document is noted. Further discussion offline, revisited later this week
The CR in 162594 is endorsed. Prepare final CR, revisited later this week
R1-163794 On the collision between eMTC SIB and MPDCCH/PDSCH in TS 36.213 Huawei, HiSilicon

R1-163006 Remaining issues for eMTC Qualcomm Incorporated
Decision: The document is noted.
R1-163093 Clarification on MBSFN subframe handling for BL/CE UEs CATT
Decision: The document is noted.

Proposal:
- Clarify the behaviour of different unicast PDSCH TM with respect to valid MBSFN subframes as follows:
  - For TM1/2/6, the UE does not expect to receive PDSCH in the valid MBSFN subframes, and they are counted as a repetition.
  - For TM9, the UE receives PDSCH and is counted as a repetition.

Continue offline discussion – Hao (Qualcomm)

R1-163780 Clarification of TM1/2/6 on MBSFN subframes Qualcomm Inc

The CR in 163780 is endorsed. Prepare final CR, revisited later this week: R1-163812
R1-163812 Clarification of TM1/2/6 on MBSFN subframes Qualcomm

R1-163781 Correction of fallback behavior for TM9 Qualcomm Inc

The CR in 163781 is endorsed. Prepare final CR, revisited later this week: R1-163813
R1-163813 Correction of fallback behavior for TM9 Qualcomm Inc

Agreement:

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- In case of collision between periodic CSI and PDSCH with repetitions, the periodic CSI is dropped for a half-duplex UE.
  - Note: may also be related to subframe definitions for DL/UL due to TA
- Prepare a CR, to be visited later this week – Hao (Qualcomm)
- Covered by R1-163811

R1-163773 Collision between PUCCH format 2 and PDSCH with repetitions Qualcomm Inc.

The CR in 163773 is endorsed.

Proposal:
- For BL/CE UEs in CEModeB configured in transmission mode 9, resource elements occupied by cell-specific reference signals shall be counted in the PDSCH mapping but/and
  - not used for transmission of the PDSCH in non-MBSFN subframes
  - used for transmission of the PDSCH in MBSFN subframes
- For BL/CE UEs in CEModeA configured in transmission mode 1, 2 or 6, the UEs shall postpone receiving the transmission in the MBSFN subframes included in the set of BL/CE DL subframes.
- For BL/CE UEs in CEModeB configured in transmission mode 1, 2 or 6, the UEs shall drop receiving the transmission in the MBSFN subframes included in the set of BL/CE DL subframes.

Continue offline discussion – Yanping (CATT). The corresponding CR agreed in principle in **R1-163705.** Refine wording and revisit later this week. – revisit on Friday - R1-163679

R1-163679 Correction on RE mapping in MBSFN subframe for BL/CE UEs in CEModeB CATT, Panasonic, Intel, Sony, Ericsson

R1-163351 **Collision between PBCH and PRS for MTC** **Ericsson**
Decision: The document is noted.
Conclusion:
- No standardized solution is necessary for handling colliding between PBCH and PRS

Re-tuning Handling
R1-162250 **eMTC corrections for 36.211 (Proposal 4) Sequans Communications**
Decision: The document is noted.
R1-162251 eMTC corrections for 36.212 Sequans Communications
R1-162445 **Issues with retuning for different UL transmissions in eMTC (TS 36.211)** **NEC**
Decision: The document is noted.
R1-163003 **Discussion of issues with rate matching for UL narrow band change** **Qualcomm Incorporated**
Decision: The document is noted.
R1-163004 **Draft CR on narrow band hopping** **Qualcomm Incorporated, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell,** Intel
Decision: The document is noted.

Conclusion:
- The CR in R1-163004 is agreed in principle. Prepare final CR, to be visited later this week – Hao (Qualcomm) The corresponding CR in R1-163702 is agreed.
- Further discussion offline w.r.t. PUCCH to PUCCH retuning as identified in R1-162445 – Yassin (NEC)
  - **R1-163709** WF on PUCCH to PUCCH retuning NEC, Qualcomm, InterDigital, Sequans, Ericsson, LGE

Proposal:
- Revoke the following agreement:

RAN1#84 agreement:
- Shortening of PUCCH 1/1a/1b in the first slot of a subframe is realized by using in the first slot with PUCCH 1/1a/1b resource mapping from symbols 1 through 6 in the first slot while maintaining the existing PUCCH 1/1a/1b DM-RS locations.

- Agree the following proposal:
  - For PUCCH 1/1a/1b, UL retuning gaps are generated by puncturing of the affected SC-FDMA symbols: last symbol and first symbol of the prior and the latter subframe respectively
    - Except if SRS subframe, shortened format of legacy behaviour is applied, i.e., shortened format is applied in the first subframe, and first symbol of the second subframe is punctured.

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Continue discussion till RAN1#85

MPDCCH Aggregation of up 2+4 PRBs

R1-162250 **eMTC corrections for 36.211 (Proposal 3) Sequans Communications**
Decision: The document is noted.
R1-162657 **Draft CR on 24 ECCE Aggregation Level for TS 36.211** **Samsung**
Decision: The document is noted.
R1-162658 **Draft CR on 24 ECCE Aggregation Level for TS 36.213** **Samsung**
Decision: The document is noted.
R1-163156 **draft CR for TS36.211 related to 2+4 PRB set** **Panasonic Corporation**
Decision: The document is noted.
R1-163159 **draft CR for TS36.213 related to 2+4 PRB set** **Panasonic Corporation**
Decision: The document is noted.
R1-163133 **MPDCCH remaining issues related to 2+4 PRB set** **Panasonic Corporation**
Decision: The document is noted.

Conclusion:
- The CRs in 2657, 2658, 3156, and 3159 are agreed in principle, except the following:
  - Text regarding "if the detected MPDCCH is located within 4 PRB set, $n_{\mathrm{PUCCH}}^{(1,p_0)}$ is the sum between $2N_{RB}^{ECCE,q}$ and the value obtained by above procedure." (Note: it occurs in multiple places)
    - This text is further discussion
- Suzuki to provide updated CRs (R1-163674 and R1-163675 for 211 and 213 respectively) including the above text – revisit on Friday.

R1-163858 CR for TS36.211 related to 2+4 PRB set Panasonic, Qualcomm, Samsung, Sequans, Sierra Wireless, Ericsson, Intel,

R1-163859 CR for TS36.213 related to 2+4 PRB set Panasonic, Qualcomm, Samsung, Sequans, Sierra Wireless, Ericsson, Intel,

R1-162252 **eMTC corrections for 36.213 (Proposal 1)** **Sequans Communications**
Decision: The document is noted.
Further discussion offline regarding proposal 1 in R1-162252

R1-162613 **Discussion on MPDCCH AL and search space for extended CP** **Huawei, HiSilicon**
Decision: The document is noted.
Proposal:
- For MPDCCH UE-specific search space configured with 2 or 4 PRB-pairs and mPDCCH-NumRepetition=1,
  - MPDCCH case A and B in Table 6.8B.1-2 of TS36.211 are defined similar as EPDCCH.
  - AL 1 should be included in Table 6.8B.1-2 of TS36.211 for MPDCCH format 0 in case B.
- For MPDCCH UE-specific search space configured with 2 + 4 PRB-pairs or mPDCCH-NumRepetition>1, and MPDCCH common search space,
  - MPDCCH case B in Table 6.8B.1-2 of TS36.211 applies for extended CP as well as special subframes with special subframe configuration 1,2,6,7,9 and normal CP, case A applies otherwise.
  - AL $\in \{1,2,4,8,12\}$ and the agreed number of monitored candidates are used for MPDCCH in case B.

Further discussion offline, revisit later this week

R1-162961 **Draft CR on MPDCCH format for Rmax=1 and 2/4 PRBs** **InterDigital Communications**
Decision: The document is noted.
Conclusion: The CR in R1-162961 is endorsed, prepare final CR, to be visited later this week
Non-repetition case:
R1-163704 – approved in R1-163676 (36211CR240) with ME+RAN boxes checked on cover sheet.
R1-163755 – approved in R1-~~163677-163844~~ (36213CR635) with red text changed to black.
Note that Format 6-2 does not need to be included.

R1-163008 **Miscellaneous corrections for eMTC (Proposals 4&5)** **Qualcomm Incorporated**
Decision: The document is noted. Covered in R1-163677.

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Agreement:
- Clarify the MPDCCH case definition when using legacy EPDCCH candidate table.
- Use Case 1 for normal subframes and normal CP, and case 3 otherwise.

Prepare a CR, to be visited later this week.

36.211

R1-162250 eMTC corrections for 36.211 (except Proposal 3) Sequans Communications
Decision: The document is noted. Discuss further offline regarding proposal 2 in R1-162250.

R1-163561 Correction of cyclic hopping term for PUSCH DMRS (TS 36.211) NEC (R1-162444)
Decision: The document is noted. Discuss further offline regarding R1-163561.
Continue discussion until RAN1#85.

R1-162610 On the granularity for SIB1-BR frequency hopping in TS 36.211 Huawei, HiSilicon
Decision: The document is noted. Discuss further offline.
CR is not needed.

R1-162611 Corrections to TS 36.211 for eMTC Huawei, HiSilicon
Decision: The document is noted.
Conclusion: the CR in 2611 is endorsed, prepare final CR, to be visited later this week.
Agreed in **R1-163698 (36211CR238)**

R1-163354 DMRS initialization of CSS for MTC Ericsson
Decision: The document is noted.
R1-163355 Missing words in PRACH starting subframe paragraph for MTC Ericsson
Decision: The document is noted.

36.212

R1-162593 On MPDCCH order identification in CE Mode B Huawei, HiSilicon
Decision: The document is noted.
Agreement:
- When an M-PDCCH is used for M-PDCCH order, the two spare bits corresponding to the location of two MSB bits in the MCS field can be fixed to 11 (in addition to resource block assignment field set to all '1's) based on option 2a or option 2b**.**
  - Option 2b is adoped

R1-163542 Identify MPDCCH order in CE mode B in TS 36.212 Huawei, HiSilicon, CATT, MediaTek, Sierra Wireless
Decision: The document is noted. Further discussion offline on 3542, prepare final CR, to be visited later week
- Including the editorial changes in 2614

Agreed in **R1-163689 (36212CR202)**

R1-162592 Identify MPDCCH order in CE mode B in TS36.212 Huawei, HiSilicon
R1-163541 Identify MPDCCH order in CE mode B in TS 36.212 Huawei, HiSilicon, CATT, MediaTek,

R1-162614 Corrections to TS36.212 for eMTC Huawei
Decision: The document is noted.

R1-163567 MCS field in DCI format 6-2 for paging for MTC Ericsson
Revision of **R1-163357**
Decision: The document is noted.
R1-163568 MCS field in DCI format 6-2 for paging for MTC Ericsson
Revision of **R1-163362**
Decision: The document is noted.

R1-163349 Channel interleaver correction for eMTC Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted. Discuss further offline.
Revised in R1-163771
Continue discussions until the next meeting

36.213

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R1-162252 **eMTC corrections for 36.213 (except Proposal 1) Sequans Communications**
Decision: The document is noted.
R1-163417 **Correction on Type1 and Type2 MPDCCH CSS transmission for Rel-13 eMTC LG Electronics**
Revision of R1-162457 (instead of 2455)
Decision: The document is noted. Discuss further offline, and prepare a final CR.
Agreed in R1-163782 **(36213CR636)**

R1-163350 **MDPCCH candidate overflow monitoring correction for eMTC Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted. Discussion further offline, and prepare a final CR.
Revised in R1-163683 and again in **R1-163772**
Agreed in R1-163677 (36213CR633r2) with correction "any of its MPDCCH candidates"

R1-163361 **MPDCCH repetition for paging and random access for MTC Ericsson**
Decision: The document is noted.

R1-162454 **Correction on PDSCH transmission timing for Rel-13 eMTC LG Electronics**
Decision: The document is noted. The CR is endorsed, final CR to be visited later this week.
Revised in **R1-163784**.
Agreed in R1-163678 (36213CR368r1), with filename to be corrected with correct CR number, and check the RAN impact box on cover sheet.

R1-162612 **Corrections to TS 36.213 for eMTC Huawei, HiSilicon**
Decision: The document is noted. The CR is endorsed, final CR to be visited later this week.
Agreed in R1-163697 **(36213CR634)**

R1-162873 **Correction of paging PDSCH transmission for MTC UE Ericsson, Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
R1-163007 **Clarifcation on CSI measurement with respect to R_CSI, max Qualcomm Incorporated**
Decision: The document is noted.
R1-163552 **WF on CSI measurement with respect to R_CSI, max Panasonic, Qualcomm**
Decision: The document is noted.

Proposal for the working assumption:
- For narrowband CSI
  - $R_{CSIMax} <= Y_{ch}$
    - the reference subframes are defined as the last subframes of the period of nCQI_ref for each hopping narrowband.
  - $R_{CSIMax} > Y_{ch}$
    - The time location of the reference subframes is not defined but UE should reflect the situation of the last subframes of Y_{ch} for each hopping narrowband.
    - The period of the reference subframes should take into account as the offset of CQI value i.e. if $R_{CSIMax} = 2$ ms, it means spectral efficiency is scaled by a factor of 2.
- For wideband CSI
  - $R_{CSIMax} < Y_{ch}$ x (number of hopping frequencies) and/or R_{CSIMax} mod (Y_{ch}) is not zero
    - The time location of the reference subframes is not defined but UE should reflect the situation of the last subframes of Y_{ch} x (number of hopping frequencies).
    - The period of the reference subframes should take into account as the offset of CQI value i.e. if $R_{CSIMax} = 2$ ms, it means spectral efficiency is scaled by a factor of 2.

Discuss further offline
R1-163008 Miscellaneous corrections for eMTC Qualcomm Incorporated
Conclusion:
- The first 2 proposals in R1-163008 are agreed. Prepare a CR, revisit later

R1-163814 Correction on RV and MPDCCH starting position Qualcomm
R1-163359 Update RRC parameter names for MTC Ericsson
R1-163360 PUCCH repetition for Msg4 for MTC Ericsson
R1-162455 Correction on Type1 and Type2 MPDCCH CSS transmission for Rel-13 eMTC LGE
Check offline whether 162455 is already included or not in other CRs

Others
R1-163005 Discussion on paging occasion overlap for eMTC Qualcomm Incorporated
Continue discussion till RAN1#85
R1-163161 RRC parameters discussion on per CE or per cell Panasonic Corporation
Conclusion:
- Regarding the potential mix CQI and ACK/NACK in the same PRB in eMTC

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- This will not have no RRC impact.
- Discuss till next meeting whether or not there is specification impact

R1-163100 Remaining issue on M determination for aperiodic CSI for eMTC before RRC configuration LG Electronics

7.1.6 Other

R1-162768 Correction on RRC parameter for configuring new TBSs Ericsson
Change the RRC parameter from *tbsTableAlt* to *tbsIndexAlt* in TS 36.213 to be aligned with RAN2 spec based on LS R1-160240 from RAN2
Decision: The document is noted and CR0612 to 36.213 Rel-12 is agreed.
R1-162767 Correction on RRC parameter for configuring new TBSs Ericsson
Decision: The document is noted and shadow CR0611 to 36.213 Rel-13 is agreed.

R1-163001 On SRS dropping under different CPs or 6-symbol UpPTS in CA Qualcomm Incorporated
The document was presented by Wanchi Chen from Qualcomm and discusses how to address the issue regarding SRS dropping in CA particularly when two or UL CCs have different CPs or when the 6-symbol UpPTS is configured.

- Proposal 1: In Rel-13 and beyond, when the UE is configured with CA of different CPs under a single TAG configuration, consider adopting the same rule regarding SRS dropping as in the case when the UE is configured with multiple TAGs in CA
- Proposal 2: In Rel-13 and beyond, when the UE is configured with a 6-symbol UpPTS under a single TAG, consider adopting the same rule reading SRS dropping as in the case when the UE is configured with multiple TAGs in CA

Discussion: Fujitsu→ ok to have a CR but limited to Rel-13. Fine to Qualcomm (CR not yet available).
Decision: The document is noted. Both proposals are agreed in principle . Prepare CR for Rel-13 only until Wednesday – Qualcomm
Friday
R1-163434 Corrections SRS dropping in CA in 36.213 Qualcomm Inc. Rel-13 36.213 CR0624 F
Decision: The document is noted and CR0624 to 36.213 Rel-13 is agreed.

7.2 LTE Release 13

7.2.1 NB-IoT

WID in RP-152284.
The objective is to specify a radio access for cellular internet of things, based to a great extent on a non-backward-compatible variant of E-UTRA, that addresses improved indoor coverage, support for massive number of low throughput devices, low delay sensitivity, ultra low device cost, low device power consumption and (optimised) network architecture.

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

R1-162634 Summary of RAN2 open items with possible RAN1 dependence Huawei, HiSilicon
Agreement:

- The DL NB-IoT UE category has total number of soft channel bits = 2112 bits.

R1-162635 Draft 36.212 CR for NB-IoT Huawei
Decision: The document is noted and agreed in R1-163405 (CR0192 rev 1).

R1-163418 Introduction of NB-IoT (36.211 CR0224 rev 3) Ericsson
Decision: The document is noted. Editor (Asbjorn) to provide update with comments by Wed.
R1-163593 Introduction of NB-IoT (36.211 CR0224 rev 4) Ericsson
Decision: The document is noted and CR0224r4 to 36.211 is agreed as the basis for the next update.

R1-163409 Draft 36.213 for NB-IoT Motorola Mobility
Decision: The document is noted. Editor (Bob Love) to have an update by Friday.
Friday:
R1-163912 Draft 36.213 for NB-IoT Motorola Mobility
Decision: The document is noted and agreed as the basis for the next update.

R1-162636 Introduction of NB-IoT Huawei

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Decision: The document (Draft 36.300 section 5 CR for NB-IoT) is noted and agreed as the basis for the next update. Next update will be provided by Friday - (Huawei)

R1-163899 **Introduction of NB-IoT Huawei**
Decision: The document is noted.

R1-163918 **Introduction of NB-IoT Huawei**
Decision: The document is noted and CR is endorsed

R1-163900 **[DRAFT]Reply LS on updated TS 36.300 section 5 for NB-IoT Huawei**
Decision: The document is noted and final LS is agreed in R1-163932 by updating Tdoc number of attachment file.
MCC post meeting: It appears that the agreed LS to RAN2 should include R1-163918 as the attachment (latest endorsed draftCR), and not the previous version of the 36.300 draftCR (R1-163899). Final LS is agreed in R1-163937 by including the correct attachment file.

R1-163426 Text Proposal for TR 36.802 (NB-IoT; Technical Report for BS and UE radio transmission and reception) Huawei

R1-163446 LS to RAN4 on NB-IoT Huawei
Approved in R1-163449 with bold/underlined addition in normal font.

Updated LS to account for 12 UL-DMRS sequences for the 3 tone case.
R1-163870 Updated LS to RAN4 on NB-IoT Ericsson
Endorsed in R1-163871, with the inclusion of the equation above the table to avoid confusion between m in the last LS and u in this one.

R1-163592 LS on NB-IoT to RAN2 (Matthew- Huawei)
Endorsed in R1-163807, including the NB-PRACH subcarrier locations table and removing bold/underline.

R1-163578 Spreadsheet of RRC parameters Huawei

R1-163579 Draft LS to RAN2 on RRC parameters
Endorsed in R1-163809, removing the sentence "RAN1 will continue to inform RAN2 about further updates to the list."

R1-163738 Jumbo LS to RAN4 (Matthew – Huawei)
Agreed in R1-163739.

Incoming LS from RAN2
R1-163852 LS on Power Headroom report
So far RAN2 does not include PHR for other cases than MSG3 but RAN2 would like to understand whether there is any need to report PHR in other cases than in MSG3.

Conclusion on LS reply:
For the typical applications targeted by rel-13 NB-IoT there may not be much benefit. In the future, there may be some benefit for longer sessions. RAN1 sees no additional impact at the physical layer for additional PHR reporting.
Draft LS reply to RAN2 in R1-163808 including the above text – Yubo (Huawei)
Endorsed in R1-163869.

Editors (211,212,213) to provide updates including agreements and working assumptions from RAN1#84bis by April 29.
Email approval deadline is May 5.

7.2.1.1 Downlink physical channels and signals

R1-163439 WF on DL OFDM baseband signal generation Intel

Agreement:
- A common OFDM baseband signal generation for NB-IoT downlink for all operation modes is described with respect to the centre frequency of the NB-IoT carrier
  - Exact equation to be provided by the TS36.211 specification editor

7.2.1.1.1 NB-PDCCH

R1-162458 Remaining issues on NB-PDCCH LG Electronics

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Agreement on starting subframes:
- The search space starting subframe reuses the principle of eMTC
  - The period reuse the principles from eMTC
    - T=R*G, G values to be determined
    - An additional offset on the value of T may be considered
- Postpone NPDCCH repetitions that overlap with transmission gap
- FFS whether to also allow an offset to the period (value FFS)
  - Additional offset = R*G1, G1=0,2,4,8

R1-163275 Remaining Details on DCI Contents Samsung

Agreement:
- In DCI format N1, ACK/NACK Resource Indication: 4 bits

R1-162773 NB-IoT - Remaining issues for NPDCCH Ericsson

Agreement:
- An NPDCCH block of subframes is scrambled in the same way as PDCCH and the scrambling is reset every 4th NPDCCH subframe.
-

R1-162757 Remaining issues on NB-PDCCH design for NB-IoT ZTE

Agreement:
- Always have 6 bits for subcarrier allocation in 36.212, 36.213 uses 5 of the 6 bits for the 15kHz case

R1-163587 WF on starting subframe Huawei
R1-163570 WF on starting subframe ZTE
R1-163260 Detail on scheduling delay for NPDSCH and NPUSCH MediaTek Inc.
Section 2
Agreements:
- $(10n_f + \lfloor n_s/2 \rfloor) \bmod T = 0$
- G={1.5, 2, 4, 8, 16, 32, 48, 64}
- eNB only configures values that result in T>=4
- T=Rmax*G

R1-163801 Remaining details of starting subframes Huawei, HiSilicon, Intel, Mediatek
Revised in R1-163804.

Agreement:
- For UE-SS, G is UE-specific
- For CSS for RAR/Msg3re-tx/Msg4, G is cell-specific and NPRACH resource-specific

R1-162625 Remaining details of NB-PDCCH Huawei, HiSilicon
R1-162626 DCI for NB-IoT Huawei, HiSilicon
R1-162772 NB-IoT - DCI content Ericsson
R1-162902 Remaining issues on NB-PDCCH Nokia, Alcatel-Lucent Shanghai Bell
R1-162972 DCI design for NB-IoT Intel Corporation
R1-162973 DL gaps and remaining details of timing relationships for NB-IoT Intel Corporation
R1-163010 NB-PDCCH Design Qualcomm Incorporated
R1-163167 Views on remaining issues of NB-PDCCH NTT DOCOMO, INC.

R1-163271 NB-PDCCH Timing and Collision Sony

7.2.1.1.2 NB-PDSCH

Numbers of repetitions
R1-163168 Views on remaining issues of NB-PDSCH NTT DOCOMO, INC.

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Agreement:
Repetitions can be applied to any supported MCS by NB-IoT

R1-162903 Remaining issues on NB-PDSCH Nokia, Alcatel-Lucent Shanghai Bell

Agreement:
- The predefined set of NB-PDSCH numbers of repetitions of the allocated subframes (i.e. N_{SF}) is {1, 2, 4, 8, 16, 32, 64, 128, 192, 256, 384, 512, 768, 1024, 1536, 2048}.
- 4 bits in DCI (for both normal and paging NB-PDSCH) indicate one value in the above set
  - Note that this shall not imply anything about how the number of PUSCH repetitions is indicated!

R1-162974 Remaining details of NB-PDSCH design Intel Corporation
Proposal 2: The maximum number of repetitions for the NB-PDSCH is 2048 and the range for NB-PDSCH repetitions can be {1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048}. The DCI indicates one of 8 values that are configured via RRC.

R1-163802 WF on scrambling sequence initialization Huawei, HiSilicon, Nokia, Samsung, CATT, Ericsson, Sharp

Agreement:
- For NB-PUSCH the scrambling sequence is according to Section 7.2 of TS 36.211
- For NB-PDSCH and NB-PUSCH

$$c_{\text{init}} = n_{\text{RNTI}} \cdot 2^{14} + \text{mod}(n_f, 2) \cdot 2^{13} + \lfloor n_s/2 \rfloor \cdot 2^9 + N_{\text{ID}}^{\text{cell}}$$

Gap configuration
R1-162774 NB-IoT - Remaining issues for NPDSCH design Ericsson
R1-162459 Remaining issues on NB-PDSCH LG Electronics
Section 2
Agreement:
- Single gap configuration is defined for NB-IoT downlink transmission.
- There can be one gap configuration for the PRB with NBPSS/NBSSS/SIB1, and with multi-PRB one optional additional gap configuration for the other PRB(s). If not configured then the same gap is used.

R1-163447 WF on Application of DL Gap for NB-IoT Ericsson, ...

Agreement:
- For each configuration, the cycle starts with transmission period followed by the subframes for the gaps
- The gap configuration is optional; if not configured it means there is no gap
- DL transmission gap does not apply to SIB transmission.
- Gaps configuration is applied for both NPDCCH CSS for paging and NPDSCH carrying the paging message
  - The same configuration is used for paging NPDCCH and NPDSCH as that of other DL transmission
  - For paging, R_NPDCCH_max refers to Rmax of paging CSS configured by eNB

R1-163569 WF on DL Gap Configuration for NB-IoT ZTE...
Agreement:
- X1 can be configured by SIB.
- When NB-PDCCH/NB-PDSCH repetitions are overlapping with a DL gap, the NB-PDCCH/NB-PDSCH repetitions are postponed to the next valid DL subframe.

R1-163448 WF on Further Details of DL Gap Configuration for NB-IoT Ericsson, Intel

Agreement:
- Starting point of gap period (SFN=0, sf=0)
- {Gap starting point periodicity, Gap size} are
  - signaled separately
    - 2 bits each
- X_1 is 2 bits
  - {32, 64, 128, 256}
- Gap starting point periodicity and gap size are
  - On an absolute number of subframes

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R1-163743 Ericsson

Agreement:
- When DL transmission gap is configured, each cycle starts with subframe (n_f, n_s) where T_g is the Gap starting point periodicity, and

$(10n_f + \lfloor n_s/2 \rfloor) \bmod T_g = 0$

  - 10240 is an integer multiple of T_g

R1-163742 WF on value set of *Gap starting point periodicity and Gap size* ZTE, Huaei, HiSi, Mediatek

Agreement:
- *Gap period :{*∈{64, 128, 256, 512}

Agreements:
- *Value set of Gap size is chosen from:*
  - *Gap size:* {1/8, 1/4, 3/8, 1/2} * Gap period

R1-163011 NB-PDSCH Design Qualcomm Incorporated
R1-163168 Views on remaining issues of NB-PDSCH NTT DOCOMO, INC.
R1-163263 Remaining issues onDL tranmsisison gap MediaTek Inc.
R1-163213 TDM transmission using UL/DL gaps Spreadtrum Communications

Other
R1-163260 Detail on scheduling delay for NPDSCH and NPUSCH MediaTek Inc.

R1-163441 WF on scheduling delay of NPDSCH and NPUSCH MediaTek, Panasonic, Huawei, Intel, ZTE, Nokia, Ericsson, Samsung

Agreement:
- Defined 4 fixed values as {8, 16, 32, 64}, the scheduling delay for NPUSCH is the value indicated by DCI

R1-163868 WF on scheduling delay of NPDSCH and NPUSCH Mediatek

Agreement:
- 3 bits indicate number of valid DL subframes. The gap between end of NPDCCH and the start of the associated NPDSCH equals k_{delay} valid DL subframes + 4ms
- Two fixed sets for different Rmax for the respective search space, above and below a threshold.
  - If Rmax <128
    - {0,4,8,12,16,32,64,128}
  - If Rmax>=128,
    - {0,16,32,64,128, 256,512,1024}

Agreement:
- The gap indicated by DCI used for NPUSCH scheduling delay indicates absolute number of subframes.

R1-162835 On non-anchor PRBs for NB-IoT multi-carrier operation Sharp

7.2.1.1.3 System information and paging transmission

Agreement:
- Confirm the working assumption that the NB-SIB1 modification period is 40.96sec
- Confirm the working assumption to use 2 bits in MIB to indicate the two LSB of hyper SFN

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Paging
R1-163012 System information and paging Qualcomm Incorporated
Section 3
R1-162758 Remaining issues on paging for NB-IoT ZTE
Agreement:
- The first valid DL subframe which is >= 4 ms later than the end of DL assignment for paging is the first subframe of NB-PDSCH transmission containing paging information.

R1-163272 Considerations on Paging Sony

R1-163343 Paging transmission Huawei, HiSilicon
Agreement:
- Confirm that the invalid subframes indicated in NB-SIB1 for the anchor carrier are also invalid for POs.

R1-162975 Remaining details of Paging for NB-IoT Intel Corporation
Section 3
R1-163276 Remaining Details on Paging Transmission Samsung

7.2.1.1.4 NB-PSS and NB-SSS

Agreement:
- Editor to remove statement in the specification on the relationship between PSS and SSS in 36.211
- Within a subframe, NB-PSS/NB-SSS use the same antenna port
- Similar to LTE there is no tx diversity scheme specified.

R1-163493 NB-SSS design for NB-IoT LG Electronics
Revision of R1-162460
R1-162627 NB-SSS design Huawei, HiSilicon
R1-163407 NB-SSS Design Qualcomm Incorporated
Revision of R1-163013

R1-162976 NB-IoT Secondary Synchronization Signal Design Intel Corporation
R1-162759 Remaining issues on NB-PSS and NB-SSS design for NB-IoT ZTE
Section 3
R1-162775 NB-IoT - NSSS Design Ericsson
R1-163333 Remaining details on synchronization signal design for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
Section 3

R1-163492 WF on NB-SSS LG
R1-163495 WF on PCID indication Huawei

Agreements:
- NB-SSS periodicity is 20ms
- The following information is indicated by the NB-SSS:
  - One of 504 PCIDs
  - 80ms boundary (4 values)
- NB-SSS sequence is composed of a length-131 frequency-domain ZC sequence and a binary scrambling sequence
  - Root indices {3..128}
- PCID is indicated by combination of ZC root index and a binary scrambling sequence
- 80ms boundary is indicated by the one of 4 time-domain cyclic shifts, {0, 33, 66, 99}
- The binary scrambling sequence is a Hadamard sequence

R1-163596 NB-SSS Evaluations Huawei, HiSilicon
Revision of R1-163577

Agreement:

- *The mapping function from NB-IoT cell ID to the root index and the index of the scrambling sequence can follow the rules as:*

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$$u = mod(PCI, 126) + 3$$

$$q = \left\lfloor \frac{PCI}{126} \right\rfloor$$

- Cyclic shift C_i ($0 \le i \le 3$) is applied to the NB-SSS signal in the ($8*k + 2*i$)-th frame, where $0 \le k \le 127$.

R1-163728 WF on scrambling sequence for NB-SSS LGE

R1-163735 WF on scrambling sequence design for NB-SSS Huawei, HiSilicon, Intel

Agreement:

- NB-SSS sequence is generated according to R1-162976 with following correction:

$$SSS(n) = e^{-\frac{j\pi r_p(n')(n'+1)}{N_{ZC}}} c_{s_p}(n)\, e^{-\frac{j2\pi l_q n}{d_{max}}}, \quad where\ n' = n\ mod\ N_{ZC}, n = \{0,1,\dots,N_{ZC}\}$$

$$l_0 = 0, l_1 = 33, l_2 = 66, l_3 = 99$$

$$d_{max} = 132$$

- The binary scrambling sequence for NB-SSS is a Hadamard sequence generated as

$$\boldsymbol{b_q(n) = Hadamard_{s_q}^{128x128}(mod(n,128))}, \quad q = 0,1,2,3$$

$$s_0 = 0, s_1 = 31, s_2 = 63, s_3 = 127$$

NB-PSS

R1-162977 Baseband signal generation for NB-IoT downlink Intel Corporation
Section 2

Agreement:

- NB-PSS is mapped to sub-carriers #0-10 of the NB-IoT carrier.

Agreement:

- NB-PDSCH/PDCCH on a given NB-IoT carrier are not mapped to the subframes containing NB-PSS/NB-SSS/PBCH on that carrier
  - Any transmission in such a subframe is postponed

R1-163333 Remaining details on synchronization signal design for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
Section 2
R1-162759 Remaining issues on NB-PSS and NB-SSS design for NB-IoT ZTE
Section 2

7.2.1.1.5 Other

R1-163009 NB-PBCH Design Qualcomm Incorporated

7.2.1.2 Uplink physical channels and signals

7.2.1.2.1 NB-PUSCH

SRS Collision Avoidance

R1-162776 NB-IoT - Remaining issues for NPUSCH design Ericsson
R1-162629 Remaining details of SRS avoidance Huawei, HiSilicon

R1-162461 Remaining issues on NB-PUSCH LG Electronics

R1-163741 WF on SRS avoidance in NB-IoT Huawei, ...

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Agreement:
- For a NB-IoT symbol that is assumed not to be used by NB-IoT UE due to avoidance of LTE SRS collision:
  - ✓ Puncturing is applied on this symbol for single tone NB-PUSCH transmission and multi-tone NB-PUSCH transmission without repetition (Z=1)

MCS Tables & RV

R1-162905 NB-PUSCH design Nokia, Alcatel-Lucent Shanghai Bell

Agreements:
- The predefined set of NB-PUSCH numbers of repetitions of the allocated RUs is {1, 2, 4, 8, 16, 32, 64, 128}.
- 3 bits in DCI indicate one value in the above set

R1-162761 Remaining issues on uplink data transmission for NB-IoT ZTE

General

R1-162978 Remaining details of NB-PUSCH Intel Corporation
R1-163341 NB-PUSCH design Huawei, HiSilicon

R1-163737 WF on resource mapping and channel interleaver for NB-PUSCH Huawei, HiSilicon, Intel, Panasonic, MediaTek, Ericsson, ZTE, Samsung, Nokia, …

Agreement
- Resource mapping for NB-PUSCH is implemented in the order of frequency first then time in TS36.211.
  - The "frequency first then in time" resource mapping continues until the end of each RU
- The channel interleaver defined in Section 5.2.2.8 in TS 36.212 is used for NB-PUSCH regardless of single tone or multi-tone transmission
  - For resource mapping $C_{mux} = N_{\text{symb}}^{\text{RU}}$

Implementation is up to the editors

R1-163015 UL Data Channel Design Qualcomm Incorporated
Section 2.1

UL tx gaps

R1-163273 Further considerations on uplink transmission gaps Sony
R1-162632 Invalid subframes configuration and handling Huawei, HiSilicon

R1-163800 WF on remaining details of timing relationships Huawei, HiSi, Intel, Sony

Agreement:
- The start of a DL transmission is >=3ms later than the end of any NPUSCH transmission for the same UE
- For any NPUSCH transmission with duration greater than X ms, a final UL gap of duration Y is inserted at the end of the NPUSCH transmission

7.2.1.2.2 Uplink narrowband DM-RS

R1-163342 NB-DMRS design Huawei, HiSilicon

R1-162730 UL DMRS sequence for NB-IoT Lenovo (Beijing) Ltd
R1-162462 Remaining issues on narrowband DMRS design LG Electronics

R1-162762 DM-RS sequence for NB-IoT ZTE
Revision of R1-16

R1-162777 NB-IoT - UL Reference signals Ericsson
R1-162906 On UL DMRS design for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

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R1-163423 WF on narrowband DM-RS design for single tone transmission LG

Agreement for single-tone:

- Use element-wise product of length-16 Hadamard code and Gold-sequence.
- Use the LTE Gold-sequence in section 7.2 of TS 36.211
  - Initialization value of second m-sequence is 35

R1-163437 WF on DMRS multi-tone evaluation methods Ericsson, Nokia, Lenovo, LG, ZTE

Agreements for multi-tone:

- DMRS symbol locations for multitone are the same as for LTE
- For 3-tone case, 12 base sequences are provided (new sequences, not truncated versions of the 6-tone sequences)
- For 6-tone case, 14 base sequences are provided
- The available base sequence in a cell for each number of tones can be indicated by a SIB; otherwise, for 3-tone and 6-tone cases it is given by CellID mod 12 for 3 tone and mod 14 for 6 tone.
  - 12-tone case follows legacy behaviour for ascertaining the base sequence.
- Define 3 cyclic shifts for the 3-tone case and 4 for the 6-tone case
  - No CSs for 12-tone case
- Cyclic shifts are indicated by SIB and not indicated in DCI
- No OCC
- Sequences are QPSK in frequency domain

FFS:

- Exact sequences for 3-tones and 6-tones are FFS based on cross-correlation evaluations – revisit on Wed
  - Cross-correlation method to be used for comparison:
    - xcorr_coeffs = NFFT * IFFT(seq1 .* conj(seq2), NFFT) / length(seq1)
  - Starting point for comparison and selection is the sequences proposed in R1-162462, R1-162730, R1-162762, R1-162906, and R1-163016.

R1-163424 WF on narrowband DM-RS design for multi tone transmission LGE

R1-163591 WF on DMRS Ericsson

Agreements:

- For each of the 3-tone base DMRS sequence, three cyclic shifts are defined as $\bar{r}(n)=e^{j 2\pi/3 \alpha n} r(n)$ where $r(n)$ is a base sequence, $0 \le n < 3$ and α is the cyclic shift $0 \le \alpha < 3$.
- For each of the 6-tone base DMRS sequence, four cyclic shifts are defined as $\bar{r}(n)=e^{j 2\pi/6 \alpha n} r(n)$, where r(n) is a base sequence, $0 \le n < 5$ and α is the cyclic shift $\alpha = \{0, 1, 2, 4\}$

Agreement:

- Take 14 of the sequences in p6 of R1-163591, as below except 1,11

m	φ(0), φ(1), φ(2), φ(3), φ(4), φ(5),					
0	1	1	1	1	3	-3
~~1~~	~~1~~	~~1~~	~~-1~~	~~-3~~	~~-3~~	~~3~~
2	1	1	3	1	-3	3
3	1	-1	-1	-1	1	-3
4	1	-1	3	-3	-1	-1
5	1	3	1	-1	-1	3
6	1	-3	-3	1	3	1
7	-1	-1	1	-3	-3	-1
8	-1	-1	-1	3	-3	-1
9	3	-1	1	-3	-3	3
10	3	-1	3	-3	-1	1
~~11~~	~~3~~	~~3~~	~~-3~~	~~-3~~	~~-3~~	~~-1~~
12	3	-3	3	-1	3	3
13	-3	1	3	1	-3	-1
14	-3	1	-3	3	-3	-1
15	-3	3	-3	1	1	-3

R1-163734 WF on 3 tone DMRS Qualcomm, Samsung, Ericsson, ZTE, Panasonic, Nokia, Sony, LG, Intel

Superseded Agreement:

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- 14 base sequences for 3-tone case are defined as $r_u(n) = e^{j\varphi(n)\pi/4}, \quad 0 \le n \le 2$

m	φ(0),φ(1),φ(2)		
0	1	-3	-3
1	1	-3	-1
2	1	-3	1
3	1	-3	3
4	1	-1	-3
5	1	-1	-1
6	1	-1	3
7	1	1	-3
8	1	1	-1
9	1	1	3
10	1	3	-3
11	1	3	-1
12	1	3	1
13	1	3	3

R1-163806 WF on 3 tone DMRS Qualcomm
Makes a correction to the table.

Agreement:
- 12 base sequences for 3-tone case are defined as $r_u(n) = e^{j\varphi(n)\pi/4}, \quad 0 \le n \le 2$

u	φ(0),φ(1),φ(2)		
0	1	-3	-3
1	1	-3	-1
2	1	-3	3
3	1	-1	-1
4	1	-1	1
5	1	-1	3
6	1	1	-3
7	1	1	-1
8	1	1	3
9	1	3	-1
10	1	3	1
11	1	3	3

The following working assumption is confirmed.

- Working Assumption:
  - Support 3 DM-RS symbols per 7 symbol period
  - The DM-RS sequence is obtained as
    - Use single tone DM-RS PUSCH spread by length 3 OCC sequence defined for PUCCH
      - The OCC ID is pseudo-randomly selected (from existing OCCs) according to $n_{cs}^{cell}(n_s, l) \bmod 3$
  - Working Assumption can be changed to 1 DMRS symbol at RAN1#84bis if significant gain is not observed compared to 1 DMRS symbol.

Agreement:
- DM RS symbols for 3.75kHz ACK/NACK are contained in the first three NB-IoT symbols
- DM RS symbols for 15kHz ACK/NACK are contained in the NB-IoT symbols 2,3, and 4 (starting from symbol 0)

7.2.1.2.3 Uplink control information

R1-163278 Remaining Issues on UCI Transmission Samsung
R1-163261 Remaining issue on UCI transmission MediaTek Inc.
R1-162628 UCI for NB-IoT Huawei, HiSilicon
R1-162778 NB-IoT - Remaining issues for UCI Ericsson
R1-162463 Remaining issues on UCI LG Electronics

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R1-162763 Remaining issues on UCI transmission for NB-IoT ZTE
R1-162836 A/N resource indication for NB-IoT Sharp
R1-162907 Remaining issues on UCI Nokia, Alcatel-Lucent Shanghai Bell
R1-162980 Remaining details of UCI and DL HARQ-ACK feedback Intel Corporation
R1-163017 Remaining details of UL control design Qualcomm Incorporated

R1-163736 WF on resource allocation for A/N transmission Huawei
R1-163440 WF on UCI LGE

Agreement for UCI:
- Fixed baseline subcarrier, and
  - 3.75kHz: 3 bits for frequency allocation, 1 bit for time allocation
    - Starts from subcarrier 45, and offset grows negatively
      - Offset values are {0, -1, -2, -3, -4, -5, -6, -7}
    - Time offset is 0,1 x 8ms
  - 15kHz: 2 bits for frequency allocation, 2 bit for time allocation
    - Starts from subcarrier zero, and offset grows positively
      - Offset values are {0, 1, 2, 3}
    - Time offset is 0,1,2,3 x 2ms

Proposed Agreement for timing reference:
- Alt. 1: A/N transmission is relative to a configured time domain reference point (at least 12 ms later than the end of NPDSCH). The time domain reference point is configured by higher layer signalling.
- Alt. 2: A/N transmission delay is relative to the end of the corresponding NPDSCH transmission plus 12ms.

Discuss Thursday

R1-163803 WF on time domain resource allocation for ACK/NACK transmission Huawei, HiSilicon, Intel, Panasonic, Samsung, ZTE

Proposed Agreement:
- Alt 1: Baseline time point for time domain allocation:
  - A/N transmission is relative to the first time reference point which is at least 12 ms later than the end of NPDSCH
  - The period of the time reference point is fixed to [16]ms.
    - The start of the period is from (SFN#0, subframe#0).
- Alt. 2: A/N transmission delay is relative to the end of the corresponding NPDSCH transmission plus 12ms.

Email approval to decide between these two alternatives – Xiaolei (Huawei)

R1-163740 WF on numbers of repetitions for ACK/NACK Nokia, ASB

Agreement:
- The predefined set of numbers of repetition for ACK/NACK resource unit is {1, 2, 4, 8, 16, 32, 64, 128}

7.2.1.2.4 Random access

R1-162464 Remaining issues on RACH transmission for NB-IoT LG Electronics
R1-162630 Remaining NB-IoT random access physical layer aspects Huawei, HiSilicon

R1-163805 WF on remaining issues about NB-PRACH power settings ZTE, HW,Hisilicon

Agreement:
- For the values of *preambleInitialReceivedTargetPower,* reuse the legacy LTE value

R1-163597 WF on remaining details of NB-PRACH Huawei

Agreements:

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- The adjustment of the uplink transmission timing is applied from the start of the first NPUSCH transmission which starts at least 12ms after the end of the corresponding timing advance command transmission.

Agreements:
- The NB-PRACH subcarrier locations are according to the following table

		"Frequency location in subcarrier offset"						
		0	12	24	36	2	18	34
"Number of subcarriers"	12	0 – 11	12 – 23	24 – 35	36 – 47	2 – 13	18 – 29	34 – 45
	24	0 – 23	12 – 35	24 – 47	Invalid	2 – 25	18 – 41	Invalid
	36	0 – 35	12 – 47	Invalid	Invalid	2 – 37	Invalid	Invalid
	48	0 – 47	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

Agreements on NB-PDCCH order:
- NB-PDCCH order is carried in format N1
- 1 bit field indicates NB-PDCCH order
- The starting number of NPRACH repetitions is included (2 bits)
- The remaining bits in DCI format N1 are set to '1'.

Agreements:
- For a given NB-PRACH resource configuration, the NB-PRACH resource
  - starts at 0ms within each SFN periodicity, and the NB-PRACH opportunity occurs at "Starting time of period" within each NB-PRACH periodicity.

Agreements
- The symbol value for NB-PRACH is 1

R1-163588 WF on the UL grant in RAR Huawei

Agreement on the UL grant in RAR:
- UL subcarrier spacing: 3.75 kHz or 15 kHz (1 bit)
- Msg3 subcarrier allocation: Same as in UL grant on NB-PDCCH
- MCS/TBS: Use 3 states to indicate the 3 options for TBS = 88 bits from agreed NB-PUSCH MCS/TBS tables. Reserve the other states for future.
  - 000 is pi/2 BPSK for ST and QPSK for MT, N_RU=4
  - 001 is pi/4 QPSK for ST and QPSK for MT, N_RU=3
  - 010 is pi/4 QPSK for ST and QPSK for MT, N_RU=1
  - Others are reserved
- Scheduling delay: Same as NB-PUSCH
- Msg3 repetition number: Same as NB-PUSCH
- Padding bits are up to RAN2 when specifying RAR

R1-163598 WF on remaining details of NB-PRACH configuration Huawei

Agreement:
- Up to 3 NPRACH resource configurations can be configured in a cell
- The fraction of the total number of subcarriers that are reserved for single-tone transmission of MSG3 cannot be zero in at least one of the resources with the number of NB-PRACH repetitions other than (32, 64, and 128)
- If a UE selects the resource reserved for single tone MSG3, MSG3 is allocated with a single tone
- 2 bits indicate the starting subcarrier index of the range reserved for indication of UE support for multi-tone Msg3 transmission by {0, 1/3, 2/3, 1}xN_sc^NPRACH
- The other subcarriers in the NPRACH resource configuration are the range for single-tone transmission of MSG3
- UE select randomly from within its range of subcarriers
- This implies that if all PRACH resources have no range reserved for the indication of UE support for multi-tone MSG3, the UE must use the NPRACH resources reserved for single tone transmission of MSG3
- NOTE: This is not an indication of UE capability which is indicated in MSG3

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R1-162857 NB-PRACH design and resource partition CMCC

R1-162983 Discussion on NPRACH baseband signal generation NEC Corporation
R1-162984 Discussion on description of NPRACH frequency hopping NEC Corporation

R1-162764 Remaing issues on PRACH for NB-IoT ZTE
R1-162779 NB-IoT - Remaining issues for NPRACH Ericsson

Agreement:
- The repetitions of NPRACH are transmitted back-to-back in the contiguous subframes within one period for NPRACH.

R1-162780 NB-IoT - Remaining issues for random access procedure Ericsson
R1-162908 Remaining issues on random accessNokia, Alcatel-Lucent Shanghai Bell
R1-162962 PRACH for NB-IoT InterDigital Communications
R1-162981 Remaining details of random access for NB-IoT Intel Corporation
R1-163018 Remaining details of Random Access Channel Qualcomm Incorporated
R1-163262 UL grant in RAR MediaTek Inc.

7.2.1.2.5 Other

Power control
R1-162631 Uplink power control Huawei, HiSilicon
R1-162921 NB-IoT - Remaining issues on UL power control Ericsson

Agreements:

- $M_{NPUSCH,c}(i)$: {1/4, 1, 3, 6,12} (reflecting UL transmission resource bandwidth normalized by 15 kHz)
  - No power adjustment parameter in DCI, i.e. $f_c(i)=0$
  - Power control for ACK/NACK: alpha = 1
  - If number of repetitions (including the initial transmission) of the allocated RUs > 2, then UE uses max power
- The set of values for power offset between NB-RS and LTE CRS is {-6, -4.77, -3, -1.77, 0, 1, 1.23, 2, 3, 4, 4.23, 5, 6, 7, 8, 9} dB.
- Value set of *powerRampingStep* is the same as LTE: {0, 2, 4, 6} dB

R1-163445 WF on NB-PRACH power rampingZTE, Ericsson
R1-163595 PRACH ramping ZTE, HW, Hisilicon, [Ericsson , Sierra wireless]…

Agreement:
- It is ran1 understanding that the following power ramping equation can be reused for NB-PRACH but one item ($-10*\log_{10}(numRepetitionPerPreambleAttempt)$ to adjust repetition's effect need to be added
  - Set PREAMBLE_RECEIVED_TARGET_POWER to *preambleInitialReceivedTargetPower* + DELTA_PREAMBLE + (PREAMBLE_TRANSMISSION_COUNTER – 1) * *powerRampingStep* – $10*\log_{10}(numRepetitionPerPreambleAttempt)$

DELTA_PREAMBLE is set to 0

R1-162904 UL power control for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-162765 Remaining issues on UL power control for NB-IoT ZTE

R1-162837 Remaining issues on transmit power control for NB-IoT Sharp
R1-163279 Remaining Details on Uplink Power Control Samsung
R1-163015 UL Data Channel Design Qualcomm Incorporated
Section 2.2

PHR:
Agreements:
- NB-PHR is computed based on a 15kHz single-tone transmit power for NB-PUSCH data transmission regardless of the actual subcarrier spacing:
  $PH(i) = P_{CMAX,c}(i)-\{P_{O\_NPUSCH,c}(1)+\alpha_c(1)\cdot PL_c\}$
- There will be 4 reportable values of PHR
  - Exact values to be determined by RAN4 and specified in 36.133.

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7.2.1.3 Other

Valid Subframes

R1-162903 Remaing issues on NB-PDSCH Nokia, Alcatel-Lucent Shanghai Bell
Proposal 1
R1-162781 NB-IoT - Valid subframes Ericsson
R1-162632 Invalid subframes configuration and handling Huawei, HiSilicon
R1-162975 Remaining details of Paging for NB-IoT Intel Corporation
Section 2

R1-163590 WF on valid/invalid subframe configurations and MBSFN subframe configuration Panasonic, ZTE, Mediatek

Agreements:
- Valid subframe configuration
  - Valid subframe configuration are optionally bit-map configured over 10ms or 40ms for inband and 10ms for standalone/guardband by NB-SIB1.
    - NOTE: For standalone/guardband this optional signaling may be useful for future coexistence
  - In the subframes that contain PSS/SSS/PBCH/NB-SIB1 in the carrier that contain PSS/SSS/PBCH/NB-SIB1
    - these subframes are invalid subframes i.e. to postpone the transmission regardless of the signalling.
  - For the remaining subframes,
    - If no bit-map is provided, these subframes are valid subframes
    - Otherwise, to follow the signalling.
- For inband
  - NB-IoT UE do not know about MBSFN subframes; they are transparent to the NB-IoT UE.
  - The UE may assume the same assumptions on legacy CRS in all valid subframes for inband
  - It is up to the network to decide whether MBSFN subframes are configured as valid or invalid.

- For valid subframe configurations for multi-PRB
  - One bit-map for the PRB with NBPSS/NBSSS/SIB1 in SIB1
  - RAN2 can decide of one or both of:
    - An additional bit-map for other PRB may be provided with dedicated signaling
    - Additional bit-map(s) for other PRBs within SIB
      - Up to RAN2 if this is per operation mode or across operation modes

R1-163589 WF on Collision Handling for NB-IoT Ericsson
Discuss offline

Tx collisions

R1-162633 Procedures for colliding transmissions Huawei, HiSilicon

Agreements:
- For standalone and guard band operations, NB-IoT channels and signals, except NB-PBCH, occupy the REs corresponding to "LTE CRS" calculated according to physical Cell_ID.
- There is no NB-IoT signaling of LTE CSI-RS or PRS.
- NB-PDCCH and NB-PDSCH are rate matched around LTE CRS for in-band operation.

R1-162782 NB-IoT - Collision handling Ericsson
R1-162909 Collision handling for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-162459 Remaining issues on NB-PDSCH LG Electronics
Section 3
R1-162760 Collision handling for NB-IoT ZTE

R1-163553 WF on scheduling collision Sony, Intel, MediaTek, Sequans
Continue offline

R1-163658 WF on scheduling collision Sony, Intel, MediaTek, Sequans, Sierra Wireless, Virtuosys, CATT, Panasonic, Huawei, HiSilicon, Neul, ZTE, Samsung

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Agreement:
- An NB-IoT UE that has received a grant from an NB-PDCCH is not required to monitor NB-PDCCH for any further DL or UL grant during the time period between the end of the NB-PDCCH that schedules the grant and the start of the corresponding NB-PDSCH or NB-PUSCH transmission

R1-163766 WF on PRACH Collision Handling for NB-IoT Ericsson, ZTE, Samsung

Agreement:
- UEs in lower coverage treat NPRACH opportunities that collide with NPRACH opportunities of higher coverage level(s) as invalid.
  - UEs only use valid NPRACH opportunities for Msg1 transmission

Other
R1-163214 On multi-carrier configuration signaling Spreadtrum Communications

7.3 LTE Release 14

7.3.1 Enhanced Licensed-Assisted Access to Unlicensed Spectrum - WID in RP-152272.

R1-163892 **Chairman's Notes of Agenda Item 7.3.1 on eLAA Ad-hoc chair (Qualcomm)**
The document was presented by Wanshi Chen from Qualcomm and .provides the outcomes of the eLAA session.
Discussion: .
Decision: The document is endorsed.

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

R1-162816 On LTE FS3 enhancements to support LAA UL Nokia, Alcatel-Lucent Shanghai Bell

7.3.1.1 PUSCH design

R1-162728 Summary on [84-14] PUSCH frame structure in eLAA Huawei, HiSilicon
Agreement:
- One symbol in a subframe containing PUSCH can be blanked
  - FFS whether to have more than one blanked symbol
  - FFS whether it's cell-specific or UE-specific

R1-163021 Email discusion summary on UL traffic multiplexing Qualcomm Incorporated

Scheduling and HARQ
R1-162322 Discussion on UL scheduling for LAA ZTE Microelectronics, Nubia
R1-162466 Multi-subframe scheduling in LAA LG Electronics
R1-162858 Further discussion on issues related to PUSCH transmission for LAA CMCC

R1-163565 WF on PUSCH multi-subframe scheduling in LAA LG Electronics, Qualcomm, Sharp
Agreement:
- DCI format(s) to schedule PUSCH transmission in k<= N subframes with single TB per subframe or two TBs per subframe
  - Value(s) of N is FFS
  - Value N is either semi-statically configured or hard-coded, to be further decided
- DCI format(s) will have the following scheduling information types:
  - Type A: common to all the scheduled subframes (appearing only once in a DCI)
    - carrier indicator, resource assignment, Cyclic shift for DM RS and OCC index
  - Type B: subframe specific information (appearing N times for N subframes scheduling)
    - NDI
  - FFS MCS is type A or type B
  - FFS HARQ process number and redundancy version are type A or type B
  - FFS details of scheduling timing indication, and whether it's type A or type B

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  - FFS: Type C: applied only to one of the scheduled subframes (appearing only once in a DCI)
    - CSI request, SRS request, TPC
  - Note: there are maybe other information fields in DCI, to be decided later
- Note: the DCI formats here may not be a complete list, e.g., depending on discussion on resource allocation for PUSCH

R1-163575 WF on eLAA PUSCH retransmission with synchronous HARQ Huawei, HiSilicon, LGE
Continue discussion till RAN1#85

R1-163572 Way forward on the PSD Issue with RB-level Multi-cluster Transmission Intel, Broadcom, Cable Labs
Continue discussion offline

R1-162130 Scheduling design for eLAA Huawei, HiSilicon
R1-162260 UL scheduling for Rel-14 eLAA CATT
R1-162320 HARQ for UL LAA ZTE Microelectronics, Nubia
R1-162352 Signaling for Flexible Timing UL Scheduling Intel Corporation
R1-162353 On the Support of Cross-burst Scheduling Intel Corporation
R1-162442 Discussion on multiple-subframe scheduling for LAANEC
R1-162663 Discussion on scheduling options for eLAA Samsung
R1-162664 Discussion on multi-subframe scheduling for eLAA Samsung
R1-162784 On LAA UL scheduling and UL grant enhancements Nokia, Alcatel-Lucent Shanghai Bell
R1-162785 On LAA UL HARQ operation Nokia, Alcatel-Lucent Shanghai Bell
R1-162800 Discussion on UL scheduling design for eLAA NTT DOCOMO, INC.
R1-162910 On UL data transmission for eLAA INTERDIGITAL COMMUNICATIONS
R1-162937 Control channel design for eLAA Mediatek
R1-163022 Control details for UL Qualcomm Incorporated
R1-163131 Discussions on the design of PUSCH for LAA CATR
R1-163140 Multi-subframe scheduling design for Enhanced LAA Ericsson
R1-163208 Multi-Cluster Scheduling Methodology Panasonic

Resource Allocation
R1-162355 On the Intermodulation Distortion Issue with Multi-cluster Transmission Intel Corporation
R1-163020 PUSCH resoure allocation granularity Qualcomm Incorporated
R1-162660 UL Waveforms for PUSCH Samsung

R1-163573 Way forward on the IMD issue with Multi-cluster Transmission (>2) Intel, Samsung, Broadcom
R1-163563 WF on PUSCH resource allocation LG Electronics, Samsung, ITL
Agreement:
- For eLAA PUSCH transmission, one interlace is the basic unit of resource allocation, which is composed of 10RBs for 20MHz
  - Working assumption: the 10RBs are spaced equally in frequency domain for 20MHz
    - Ex for 20MHz eLAA SCell: interlace 0 is composed of RBs 0,10,20,...,90
    - Send an LS to RAN4 asking whether or not RAN4 sees issues with the working assumption. RAN1 also discussed the possibility of having unequal spacing in frequency domain for the 10-RB interlace based resource allocation – Jeongho (Intel) - R1-163703 – approved in **R1-163683**
  - FFS the case of other system bandwidth(s)
- A UE can be assigned one or more interlaces
  - The total number of RBs used for transmission should be a multiple of 2,3 and 5
  - Decide one of the following alternatives:
    - Alt 1: UL resource allocation type 0 is used to allocate multiple interlaces to a UE
      - UL grant indicates start index and allocated number of interlaces with consecutive indices
    - Alt 2: bitmap based resource allocation
    - Alt 3: predefined resource allocation patterns
  - FFS: excluding some UL RBs from the resource allocation

R1-163584 WF on PUSCH transmissions in eLAA Huawei, HiSilicon
Agreement:
- Confirm the working assumption
  - The minimum latency is 4ms between the subframe carrying the UL grant and subframe(s) of the corresponding PUSCH(s)

Agreement:
- For the UL DMRS for eLAA,

- Reuse the legacy UL DMRS generation sequence
  - That is, the sequence is generated based on the transmitted bandwidth and mapped in a way similar to that of the legacy resource allocation type 1
- The symbol position of the UL DMRS of eLAA is the same as the UL DMRS position in LTE PUSCH subframe
- The frequency position of the UL DMRS is the same as the PUSCH REs

R1-162259 PUSCH design for Rel-14 eLAA CATT
R1-162321 On UL Resources Allocation for PUSCH ZTE Microelectronics, Nubia
R1-162351 Uplink Waveform for eLAA Intel Corporation
R1-162354 On the Coexistence Issue with Multi-Cluster Transmission Intel Corporation
R1-162439 PUSCH resource allocation for LAA NEC
R1-162465 PUSCH resource allocation in LAALG Electronics
R1-162583 Resource allocation for RB interleaved PUSCH for eLAA Huawei, HiSilicon
R1-162660 UL Waveforms for PUSCH Samsung
R1-162756 RB allocation for PUSCH Sequans Communications
R1-162755 Considerations for eLAA UL Carrier Allocation Sequans Communications
R1-162799 Discussion on PUSCH design for eLAA UL NTT DOCOMO, INC.
R1-162817 UL waveform for LAA PUSCH Nokia, Alcatel-Lucent Shanghai Bell
R1-162936 eLAA PUSCH design Mediatek
R1-162985 Resource allocation and channel access for PUSCH ITRI, Acer Inc.
R1-163019 PUSCH design details Qualcomm Incorporated

R1-163758 WF on PUSCH structure LG Electronics, CATT, WILUS
R1-163829 WF on further details of DCI contents for multi-TTI transmission Qualcomm
R1-163830 WF on multi-TTI scheduling Mediatek

Others
R1-162131 Discussion on CCA gap and symbol position for PUSCH and SRS for eLAA Huawei, HiSilicon
R1-162323 Consideration of LBT failure in LAA UL HARQ operation ZTE Microelectronics, Nubia
R1-162443 Discussion on LAA UL partial subframe transmission NEC
R1-162554 eLAA Measurements and Carrier Selection Procedure Sony
R1-162604 Design for frame structure 3 with DL and UL subframes for eLAA Huawei, HiSilicon
R1-162661 Discussion on DTX handling methods for UL HARQ in eLAA Samsung
R1-162662 Discussion on UL power control for UL LAA Samsung
R1-162783 On LAA UL/DL Scheduling Combinations Nokia, Alcatel-Lucent Shanghai Bell
R1-162838 Uplink subframe structure in LAA carrier Sharp
R1-163023 PUSCH power control Qualcomm Incorporated
R1-163139 On DMRS design for UL in Enhanced LAA Ericsson
R1-163141 On UL Subframe Structure for Enhanced LAA Ericsson
R1-163165 Discussion on Partial Subframe Utilization for PUSCH Beijing Xinwei Telecom Techn.
R1-163207 Uplink Subframe Structure Panasonic

7.3.1.2 SRS design

R1-162729 Summary on [84-15] SRS without PUSCH in eLAA Huawei, HiSilicon
R1-163585 WF on SRS without PUSCH in eLAA Huawei, HiSilicon, Qualcomm

Agreement:
- Working assumption: Periodic SRS without PUSCH is NOT supported in Rel-14 eLAA WI
- A-periodic SRS without PUSCH is supported at least in DL ending partial subframes in Rel-14 eLAA WI
  - FFS the case of UL subframes
- LBT for aperiodic SRS without PUSCH
  - 25us one-shot LBT within eNB MCOT;
  - Cat 4 LBT outside of eNB MCOT
    - FFS contention window size parameters, including possibility of non-adapting contention window size
  - FFS no LBT if SRS is transmitted within 16us of the DL transmission within eNB MCOT
  - FFS whether or not the eNB can indicate a LBT type

Agreement:
- Aperiodic SRS without PUSCH can be triggered by dynamic signaling at least via DL grants
  - UE is configured by RRC one or more sets of SRS parameters
    - The configuration details are FFS
  - FFS other possible triggering mechanisms, e.g.:

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- Group DCI
- UE-specific DCI
- One or several of the above options may apply

R1-163586 WF on general SRS aspects in eLAA Huawei, HiSilicon, CATT

Agreement:

- Only wideband SRS transmission in supported in eLAA
  - Existing max # SRS RBs for a given system bandwidth is the baseline
    - FFS whether or not to extend/shift to # of RBs > max # RBs in the legacy case
- Working assumption: SRS is based on legacy comb structure
  - As a baseline, comb = 2 and 4
  - FFS whether or not support different comb value(s)

Proposal – Continue discussion till RAN1#85

- Alt 1: A-periodic SRS without PUSCH is supported also in regular UL subframes, where the SRS is located in the 2nd symbol of the subframe
  - Supported by: Nokia, ASB, QC, LG (2nd choice), HW, HiSi, DCM, Kyocera, Intel, WILUS, ITRI, ZTE, E/// (2nd choice)
  - Objected by: SS, Panasonic, MTK, Broadcom
- Alt 2: A-periodic SRS without PUSCH is supported also in regular UL subframes, not to be multiplexed with other UEs' PUSCH transmission in the same subframe and the SRS is located in the last symbol of the subframe
  - Supported by: E///, CATT, LG, MTK (2nd choice)
  - Objected by: Pana, Broadcom
- Alt 3: A-periodic SRS without PUSCH is NOT supported also in regular UL subframes
  - Supported by: SS, MTK, Pana, Sharp, Broadcom, Lenovo
  - Objected by: HW, HiSi, DCM, QC, Nokia, ASB, CATT

R1-162101 Further details on SRS transmission for eLAA Huawei, HiSilicon
R1-162261 SRS design for Rel-14 eLAA CATT
R1-162324 SRS design for eLAA UL ZTE Microelectronics, Nubia
R1-162356 SRS Transmission for eLAA Intel Corporation
R1-162467 SRS transmission in LAA LG Electronics
R1-162665 Discussion on SRS for UL LAA Samsung
R1-162752 SRS design for eLAA Kyocera Corporation
R1-162801 Discussion on SRS design for eLAA UL NTT DOCOMO, INC.
R1-162911 On SRS for eLAA INTERDIGITAL COMMUNICATIONS
R1-162918 On LAA SRS Design Nokia, Alcatel-Lucent Shanghai Bell
R1-162938 Considerations on SRS for eLAA Mediatek
R1-162986 SRS position in eLAA ITRI
R1-163024 SRS design details Qualcomm Incorporated
R1-163124 Aperiodic SRS transmission without PUSCH for eLAA ETRI
R1-163142 On Aperiodic SRS Transmission with PUSCH for Enhanced LAA Ericsson
R1-163143 On Aperiodic SRS Transmission without PUSCH for Enhanced LAA Ericsson
R1-163297 SRS transmission in eLAA WILUS Inc.
R1-163304 SRS design in Rel-14 eLAA Innovative Technology Lab Co.

7.3.1.3 Uplink control information on an LAA SCell

R1-162262 UCI transmission for Rel-14 eLAA CATT
R1-162939 PUCCH design in eLAA Mediatek
R1-163145 Transmission of uplink control information on an LAA SCell in DL partial subframes Ericsson

Agreement:

- PUCCH on LAA SCell is not introduced in eLAA within the current scope of the work item
  - The introduction of PUCCH at a later stage in Rel-14 is not precluded

Agreement:

- Simultaneous L-cell PUCCH and LAA SCell PUSCH transmission is supported by the UE
  - Note: Not configuring this would impact PUSCH transmission opportunities on the LAA SCell
  - Note: whether this feature is optional or mandatory is a separate discussion
  - Note: this does not necessarily imply that a UE needs support simultaneous PUCCH and PUSCH within one band or adjacent bands

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Working assumption:

- eLAA supports transmission of UCI including at least HARQ-ACK on PUSCH within a "cell group" consisting of only LAA SCells at least for self-scheduling
  - No PUCCH on any SCell in the CG
  - This cell group is not referring to a PUCCH cell group
  - FFS: Timing relationship between DL transmissions and HARQ-ACK

Agreement:

- Transmission of aperiodic CSI on an LAA SCell is supported at least for aperiodic CSI for an unlicensed carrier
  - Both aperiodic CSI only (without UL-SCH) and aperiodic CSI with UL-SCH are supported
    - FFS the conditions for aperiodic CSI only on an LAA SCell
- Transmission of periodic CSI on an LAA SCell is not supported within the current scope of the eLAA work item
  - The introduction of periodic CSI on an LAA Scell at a later stage in Rel-14 is not precluded

R1-162318 SR/P-CSI transmission on eLAA carrier Guangdong OPPO Mobile Telecom.
R1-162319 HARQ-ACK transmission on eLAA carrier Guangdong OPPO Mobile Telecom.
R1-162325 Discussion on UCI transmission on LAA SCell ZTE Microelectronics, Nubia
R1-162357 Transmission of Uplink Control Information on an LAA Scell Intel Corporation
R1-162441 PUCCH enhancement for LAA NEC
R1-162468 UCI transmission in LAA LG Electronics
R1-162469 PUCCH design in LAA LG Electronics
R1-162584 PUCCH format for eLAA Huawei, HiSilicon
R1-162605 UCI transmission for eLAA Huawei, HiSilicon
R1-162666 Discussion on PUCCH for UL LAA Samsung
R1-162667 Discussion on UCI transmission for eLAA Samsung
R1-162731 UCI transmission on LAA Scell Lenovo (Beijing) Ltd
R1-162802 Discussion on UCI transmission and PUCCH design for eLAA UL NTT DOCOMO, INC.
R1-162818 DL HARQ-ACK for eLAA Nokia, Alcatel-Lucent Shanghai Bell
R1-162819 UL waveform for control information in eLAA Nokia, Alcatel-Lucent Shanghai Bell
R1-162859 Discussion on Uplink control information transmission on LAA Scell CMCC
R1-162912 UCI on eLAA SCell INTERDIGITAL COMMUNICATIONS
R1-163025 PUCCH design details Qualcomm Incorporated
R1-163144 Transmission of uplink control information on an LAA SCell in UL subframes Ericsson

R1-163730 WF on channel access of UCI transmission for eLAA SCell Docomo

7.3.1.4 PRACH design

R1-162471 Random access procedure in LAA LG Electronics

R1-163785 WF on PRACH procedure in LAA LG Electronics, Intel, Samsung

Working Assumption:

- PRACH resource configuration in time and frequency in LAA SCell:
  - RRC configuration of frequency resource(s), sequence set, and time domain resources
    - Omitting time domain resources from the RRC configuration can be studied, considering e.g. interactions with LBT.
  - FFS whether any of the following can be dynamically adapted by PDCCH, or deterministically derived by the UE:
    - time domain resources
    - frequency resources for actual transmission
    - sequences for actual transmission
    - If using PDCCH, FFS whether common or UE-specific

R1-163818 WF on PRACH waveform Nokia, Alcatel-Lucent Shanghai Bell, CATT, Panasonic, Samsung

Proposals:

- LAA-PRACH is based on LTE PRACH format 0 and/or format 4 repeated *N* times in frequency
  - The value of *N* is configurable and ≥ ~~2~~includes at least {1, 2, ...}
  - The placement of the PRACH clusters in frequency shall be able to fulfil the ETSI regulation on occupied channel bandwidth
    - PRBs for LAA-PRACH for each value of *N* are defined in the specification, exact positions are FFS
  - FFS: CP of the PRACH format 0 is shortened by [1 symbol] to provide room for LBT

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– FFS: The value of Timing Advance for LAA-PRACH transmission is configurable

R1-163853 WF on PRACH waveform Ericsson
Proposal:
- Preamble durations of up to 1 ms are supported in eLAA.
- PRACH is transmitted in one or more of RB interlaces
  – The interlaces to use is configured by RRC
- PRACH preamble is based upon repetition of one DFTS-OFDM symbol of the same length as a PUSCH DFTS-OFDM symbol.
- A region for LBT is provided by not transmitting one or more OFDM symbols

Continue evaluation both options as listed below till RAN1#85

R1-163821 On Performance of PRACH for Enhanced LAA Ericsson
Revision of R1-163147

R1-162132 PRACH for eLAA Huawei, HiSilicon
R1-162263 PRACH design for Rel-14 eLAA CATT
R1-162326 PRACH Design for LAA ZTE Microelectronics, Nubia
R1-162358 PRACH Design for eLAA Intel Corporation
R1-162470 Random access preamble in LAA LG Electronics
R1-162527 Discussion on PRACH design for LAA HTC
R1-162668 PRACH Transmission Aspects Samsung
R1-162669 Discussion on enhanced RA procedure for UL LAA Samsung
R1-162803 Discussion on PRACH for eLAA UL NTT DOCOMO, INC.
R1-162919 Discussion on PRACH design for eLAA Nokia, Alcatel-Lucent Shanghai Bell
R1-162940 PRACH desgin in eLAA Mediatek
R1-162995 Discussion on PRACH for eLAA Shenzhen Coolpad Technologies
R1-163026 PRACH design details Qualcomm Incorporated
R1-163146 PRACH Design for Enhanced LAA Ericsson
R1-163209 PRACH Bandwidth on Unlicensed Carriers Panasonic

7.3.1.5 Channel access framework

Extending the agreement reached during the Rel-13 WI on LAA and for corresponding agreed channels and signals

Agreement:
- If the sum total duration of DL and UL transmissions [and UL LBT] is less than the obtained channel occupancy duration, it is sufficient for the UE(s) to perform a single 25us LBT to access the channel and perform UL transmission
  - FFS the conditions, if any, on the usage of 25us LBT especially w.r.t. traffic class
  - FFS the […] part

R1-163632 WF on UL Channel Access Schemes Ericsson
Revised in R1-163810
R1-163822 WF on triggered modification of UL LBT parameters Ericsson
R1-163828 WF on supporting trigger based transmission for UL in eLAA Qualcomm
R1-163707 WF on UL LBT Intel, Samsung
R1-163576 WF on block CCA at UE Samsung
R1-163760 WF on UE to UE interference handling LG

R1-162102 Further details on UL LBT to enable UE multiplexing of uplink transmissions Huawei, HiSilicon
R1-162851 Discussion on LAA UL LBT Design BROADCOM LIMITED
R1-162852 Discussion on LAA SRS and interlaced transmission for PUSCH BROADCOM LIMITED
R1-162982 Energy Detection Threshold for UL LAA Channel Access Mechanism CableLabs
R1-163150 On Channel Access Procedures for Enhanced LAA Ericsson
R1-163148 On Performance of UL Channel Access Procedures for PUSCH with Self-Carrier Scheduling Ericsson

R1-163707 Way forward on UL LBT Intel, Samsung
Proposal:
- The scheduled UL subframe is not within an obtained channel occupancy duration, Cat-4 LBT is used for UL LBT.
  - FFS: Whether the UL maximum contention window size can be smaller than that for DL category 4 LBT
- Energy detection threshold used for UL LBT for both self-carrier and cross-carrier scheduling is based on the energy detection threshold rule for DL LBT.
- LBT for UL grant only transmission by eNB follows Cat-4 LBT with high priority.

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- FFS: the priority class to be used for UL grant only transmission.

R1-163810 WF on UL Channel Access Schemes Ericsson

R1-162128 UL category 4 LBT with eNB assistance Huawei, HiSilicon
R1-162129 Contention window size adjustment for UL category 4 LBT for eLAA Huawei, HiSilicon
R1-162264 UL channel access schemes for Rel-14 eLAA CATT
R1-162327 Frame design and signalling for LAA UL based on FS3 ZTE Microelectronics, Nubia
R1-162328 Discussion on UL LBT for LAA ZTE Microelectronics, Nubia
R1-162329 LBT for Frequency reuse and Multiplexing in Uplink ZTE Microelectronics, Nubia
R1-162330 TPC and PHR for UL LAA ZTE Microelectronics, Nubia
R1-162331 On UL Channel Access Framework for Enahnced LAA Fujitsu
R1-162359 UL LBT Details Intel Corporation
R1-162360 Introduction of non-scheduled UL access for eLAA Intel Corporation
R1-162440 Channel access for LAA UL NEC
R1-162472 Evaluation of LBT operation in LAA UL LG Electronics
R1-162473 LBT schemes in LAA UL LG Electronics
R1-162474 Impact of UE-to-UE interference on LAA performance LG Electronics
R1-162528 Dynamic carrier selection for LAA HTC
R1-162555 UL Channel access mechanism design in eLAA Sony
R1-162556 eLAA contention window size adjustments Sony
R1-162557 UE measurements and reporting in eLAA Sony
R1-162575 LBT for UL grant transmission Intel Corporation
R1-162602 Discussion on the applications of LBT options in eLAA Huawei, HiSilicon
R1-162603 Other issues related to LBT for eLAA Huawei, HiSilicon
R1-162670 LBT for cross-carrier scheduling Samsung
R1-162671 Discussion on LBT for self-carrier scheduling Samsung
R1-162732 LBT mechanism for LAA uplink Lenovo (Beijing) Ltd
R1-162753 Channel Access Scheme for UE multiplexing Kyocera Corporation
R1-162804 Discussion on channel access framework for eLAA UL NTT DOCOMO, INC.
R1-162839 Methods of UL LAA channel access Sharp
R1-162854 Discussion on slot misalignment between LAA and Wi-Fi BROADCOM LIMITED
Withdrawn
R1-162913 UL channel access for eLAA INTERDIGITAL COMMUNICATIONS
R1-162920 Channel Access for LAA UL Nokia, Alcatel-Lucent Shanghai Bell
R1-162941 eLAA Uplink channel access Mediatek
R1-162942 On priority classes for uplink LBT Mediatek
R1-163027 UL channnel access Qualcomm Incorporated
R1-163028 Cross-carrier scheduling for UL Qualcomm Incorporated
R1-163123 Discussion on UL LBT for eLAA ETRI
R1-163149 On Performance of UL Channel Access Procedures for PUSCH with Cross-Carrier Scheduling Ericsson
R1-163151 Channel Access Procedures for UL Grant for Enhanced LAA Ericsson
R1-163152 On Signaling of UL channel access parameters Ericsson
R1-163153 On Channel Access Procedures for PRACH and SRS Transmissions Ericsson
R1-163191 Discussion on LAA Uplink Channel Access III
R1-163204 Error Cases due to Failed Clear Channel Assessment for UL Transmissions Panasonic
R1-163298 Discussion on UL channel access in eLAA WILUS Inc.
R1-163305 UL LBT design in Rel-14 eLAA Innovative Technology Lab Co.

7.3.1.6 Other

R1-162475 Initial signal in LAA uplink LG Electronics
R1-162476 Power control in LAA uplink LG Electronics
R1-163762 WF on UL power control LG

R1-162543 HARQ feedback for UL LAA transmission Spreadtrum Communications
R1-162644 Synchronous and asynchronous HARQ method for eLAA Huawei, HiSilicon

7.3.2 Support for V2V services based on LTE sidelink - *WID in RP-160649*

R1-163893 Chairman's Notes of Agenda Item 7.3.2 on V2V Ad-hoc chair (Qualcomm)

The document was presented by Wanshi Chen from Qualcomm and .provides the outcomes of the V2V session.
Discussion: .
Decision: The document is endorsed.

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

R1-163685	LS to RAN1 on RAN2 agreements related to V2V	RAN WG2

R1-163857	V2V offline discussion summary LGE	

7.3.2.1 Enhancement to sidelink physical layer structure

R1-162361	Enhancements of sidelink physical layer structure for PC5 V2V communication	Intel Corporation
R1-162825	L1 Format for V2V Transmissions using Sidelink	Ericsson LM

7.3.2.1.1 DM-RS for PSCCH and PSSCH

R1-162118	Further evaluations of DMRS for PSSCH/PSCCH	Huawei, HiSilicon
R1-162362	On DMRS physical structure enhancements for PSCCH and PSSCH	Intel Corporation
R1-162538	Evaluation of DMRS enhancement for V2V with high Doppler	Nokia, Alcatel-Lucent Shanghai Bell
R1-162673	DMRS enhancement for PSSCH/PSCCH	Samsung
R1-162826	Link Level Simulations for Sidelink	Ericsson LM
R1-163030	Techniques to address PSD limitation	Qualcomm Incorporated
R1-163155	Link performance of DMRS Enhancement for V2V PSCCH/PSSCH	Beijing Xinwei Telecom Techn.

R1-153611	WF on supporting 500km/h relative speed case	LG Electronics, Huawei, HiSilicon, Samsung, CATT
R1-163524	WF on DMRS Mapping for PC5 based V2X	Ericsson, Qualcomm, Vodafone
R1-163624	WF on support of the increased subcarrier spacing for V2V communication	Intel, ITRI

Conclusion:

- Send an LS to RAN4 asking for urgent feedback especially regarding feasibility, RAN4 specification impact, and implementation impact of the following 4 design alternatives, and kindly request a response as soon as possible. Note that RAN1 is intended to conclude this topic during this week - Stefano (Ericsson)
  - The company names will NOT be included in the LS
  - Add as the background that RAN#71 agreed:
    - *The outcome of this work item should be able to support a relative speed of up to 500 km/h with enhancements/changes (if necessary) to the physical layer structure designed for the relative speed up to 280 km/h.*

The four alternatives:

- Alt 1:
  - "4V structure" for PSSCH/PSCCH is kept (which is already an agreement in RAN1)
  - In order to support 500 km/h relative speed case, lowering the coding rate can be used
    - FFS how to adapt MCS, RB size, and/or number of transmission subframes depending on the situation
      - This may or may not have any specification impact
  - Confirm the working assumption:
    - 15 kHz subcarrier spacing with 1 msec TTI length
  - Supported by:
    - LG Electronics, Huawei, HiSilicon, Samsung, CATT, ZTE, Nokia, ASB, OPPO (9)
  - Objected by:
    - E///, QC
- Alt2
  - For PC5-based V2V:
    - A DMRS RE is transmitted every 6th subcarrier in all symbols of the scheduled transmission
      - DFT precoding is NOT applied to data REs
      - Offset of the DMRS RE within a RB is FFS
      - FFS between rate matching and puncturing
      - FFS details of the DMRS sequence
  - Confirm the working assumption:
    - 15 kHz subcarrier spacing with 1 msec TTI length
  - Supported by: Ericsson, Qualcomm, Vodafone (3)
  - Objected by: SS, HW, HiSi, CATT, Nokia, ASB
- Alt 3:

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  - Increased subcarrier spacing from 15kHz to 60kHz is supported for LTE PC5 V2V communication
  - Supported by: Intel, ITRI (2)
- Alt 4: Alt 2 + Alt 3 (with 30kzh tone spacing)
  - Supported by: Intel (1)

Friday
Alt.5: Alt.1 + adapt MCS, the number of RBs, and the number of transmission subframes depending on the UE absolute speed and UE synchronization source (e.g. GNSS or eNB
FFS one or more PSCCH format(s) need to be supported
Supported by Ericsson, Huawei, HiSilicon, LGE, ZTE, CATT, Nokia, Vodafone, CATR, Samsung, Sharp, Sony, ASB, Lenovo, OPPO, Xinwei

RAN1 Chair→ can alt.5 be agreed
Objection from Qualcomm – see control channel issue and would like to get RAN4 feedback – ok to take it as working assumption
CATT→ afraid that situation will be identical at next meeting
T-Mobile→ 16 companies supporting, one against – why not to declare a working agreement and move one
Intel→ prefer to keep the WA approach
Nokia

R1-163692 LS on PC5 DMRS and L1 format for V2V Ericsson
The LS is approved in R1-163693, by removing "demodulation" from "demodulation feasibility".

R1-162265 DMRS enhancement in PC5-based V2V CATT
R1-162409 Link level performance of DMRS for V2V ZTE
R1-162477 Discussion on DMRS for PSCCH and PSSCH LG Electronics
R1-162539 Considerations on V2V Enhancements for 500kmph Nokia, Alcatel-Lucent Shanghai Bell
R1-162540 On DMRS enhancements for V2V - Summary Nokia, Alcatel-Lucent Shanghai Bell
R1-162559 Discussion on DMRS enhancement and operation for V2V Sony
R1-162860 Discussion on DMRS Enhancement for PC5-based V2V CMCC
R1-162990 DM-RS Enhancement to sidelink physical layer structure in the High Doppler Case for V2V Services based on LTE sidelink ITRI
R1-163029 DM-RS Enhancements for V2V PSCCH and PSSCH Qualcomm Incorporated

7.3.2.1.2 DM-RS for PSBCH

R1-162674 Email discussion on PSBCH evaluation assumptions Samsung
R1-162266 DMRS enhancement for PSBCH CATT
R1-162412 DMRS design of PSBCH ZTE
R1-162478 Discussion on DMRS for PSBCH LG Electronics
R1-162675 DMRS design and periodicity for PSBCH Samsung

R1-162119 PSBCH DMRS enhancements Huawei, HiSilicon
R1-162391 Discussion on DM-RS for PSBCH for sidelink-based V2V communication Fujitsu
R1-162932 On DMRS physical structure enhancements for PSBCH Intel Corporation
R1-163031 DM-RS Enhancements for V2V PSBCH Qualcomm Incorporated
R1-163158 Link Performance of DMRS Enhancement for V2V PSBCH Beijing Xinwei Telecom Techn.

7.3.2.1.3 Other

7.3.2.2 Enhancement to sidelink resource allocation

R1-162815 Observations on CAM Message Periodicity and Payload Ericsson LM
R1-162833 Discussion on V2X PC5 Scheduling, Resource Pools and Resource Patterns Ericsson LM

7.3.2.2.1 Details of sensing with semi-persistent transmission

R1-162268 Evaluation results of PC5-based V2V CATT
R1-162363 On sensing design details for sidelink V2V communication Intel Corporation
R1-162480 System level evaluation results of PC5 based V2V resource allocation options LG Electronics
R1-162830 System Level Simulation Results of Potential PC5 Design Options for V2X Ericsson LM
R1-163032 Details of sensing for V2V Qualcomm Incorporated
R1-163176 Discussion on details of sensing with semi-persistent transmission NTT DOCOMO, INC.
R1-163425 Evaluation Results on Sensing Based and Geo Based Resource Scheduling for V2V GM - OnStar Europe
Revision of R1-163309

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R1-163612 WF on resource sensing LG Electronics, Huawei, HiSilicon, CATT, Nokia, OPPO, Samsung, Sony, ITL, Beijing Xinwei, Sequans, Ericsson, DOCOMO, Panasonic, Potevio, ITRI, Sharp, NEC, ZTE, Fujitsu

Agreement:

- Both SA decoding and energy measurement are supported for sensing in UE autonomous resource selection.
  - FFS how each of SA decoding and energy measurement is used.
  - Note: strive for a design with managable complexity especially in terms of SA blind decodes, UE buffer, etc.

Agreement:

- If at TTI n resource selection/reselection is triggered in UE autonomous resource selection mode,
  - The UE at least senses between TTI n-a and TTI n-b (FFS a and b with a>b>0), where a and b are integers
    - Working assumption: The values a and b are common for V2V UEs.
  - UE selects time-frequency resource(s) for PSSCH
  - UE transmits SA in TTI n+c where c is an integer
    - FFS whether c is a fixed value (>= 0) or variable.

Agreement:

- In UE autonomous resource selection mode, SA can be transmitted for every TB.
  - FFS whether to support transmitting and/or receiving TB without SA
  - FFS whether every data (re)transmission for the same TB has the associated SA transmission.

Agreement:

- In UE autonomous resource selection mode,
  - UE transmits SA at TTI n+c indicating the associated data which is transmitted at TTI n+d (FFS d with d>=c), where c and d are integers
  - UE indicates whether it intends to reuse the frequency resource signaled for transmission at TTI n+d for potential transmission at TTI n+e for another TB (FFS e with d<e), where e is an integer
    - FFS whether this indication is implicit or explicit.
    - FFS if and how to signal the value for e
    - FFS how the UE determines the value for e
    - FFS whether e is a single value or can be multiple values
    - FFS whether, and if so how, a UE can notify later that it no longer intends to use the resource at TTI n+e.
    - FFS how the UE decides to indicate this
    - Other details FFS

R1-163623 WF on Priority Support for V2V Communication Intel, Ericsson, III
R1-163879 Harmonized WF on Priority Support for V2V Communication Intel, Ericsson, III, Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell, CATT, ITRI, LGE, Samsung

Agreement:

- Proposal 1:
  - Priority handling is supported over PC5 for eNB-scheduled and UE- autonomous V2V communication
- Proposal 2:
  - The priority information is taken into account in the resource (re)selection for UE-autonomous mode
    - Further details are FFS
- Proposal 3:
  - Down-select between two alternatives at RAN1#85 meeting
    - Alt.1 Priority information is signaled in SCI
    - Alt.2 Priority information is not signaled in SCI

Conclusion for Energy measurement for sensing:

- Continue discussion until next meeting for the following options for the purpose of resource selection for PSSCH
  - Measurement of reception power of the decoded SA
  - Measurement of energy in SA resource
  - Measurement of energy in data resource

Agreement:

- Reselection is triggered if
  - A counter meets an expiration condition, or
  - The counter is reset to a value when reselection is triggered.

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- FFS whether this value is random, fixed, and/or the same across UEs
- UE identifies that the current resource allocation cannot fulfil the requirement, e.g., latency, reliability, priority, fairness, or QoS requirement (details FFS), or
- FFS how to impose limitation in the resource size selected by a UE
- Working assumption: UE detects resource allocation (including the indication of the intention of reusing the frequency resource as per the existing agreement) of another UE which potentially overlaps with its current resource allocation (including the indication of the intention of reusing the frequency resource as per the existing agreement) and the detected situation meets a condition, or
- The condition is FFS, not precluding applying different conditions for different priorities (if any relevant case happens in priority handling from RAN1 point of view).
- eNB triggers reselection, or
- FFS whether some information needs to reported from UE to eNB
- FFS additional condition(s), e.g.,
- If it is supported that a UE can notify later that it no longer intends to use the resource at a future TTI, reselection triggering condition related to this notification.
- Reselection triggered by notification on resource collision from another UE
- Reselection triggered by sensing of resources utilization above a threshold
- Reselection triggered by higher layer
- Other conditions are not precluded

Send an LS to RAN2 to capture the agreements on resource allocation – Hanbyul (LGE)

R1-162267 Discussion on UE autonomous resource allocation in PC5-based V2V CATT
R1-162340 Discussion on the SPS configuration Guangdong OPPO Mobile Telecom.
R1-162413 Discussion on V2V SPS resource scheme ZTE
R1-162479 Discussion on sensing with semi-persistent transmission for PC5 based V2V LG Electronics
R1-162560 Discussion on sensing for autonomous resource selection Sony
R1-162641 Details of sensing based collision avoidance Huawei, HiSilicon
R1-162676 Sensing and resource selection for collision avoidance Samsung
R1-162823 Distributed Resource Allocation for V2X over PC5 Ericsson LM
R1-162933 On combination of sensing and geo-based transmission techniques for sidelink V2V communication Intel Corporation
R1-163128 Resource allocation and selection enhancement for V2V communications CATR
R1-163202 On resource control/selection with sensing Nokia, Alcatel-Lucent Shanghai Bell
R1-163366 On sensing and semi-persistent transmission for V2V sidelink INTERDIGITAL COMMUNICATIONS

7.3.2.2.2 Signaling to/from eNB

Including details of SPS signaling and UE reporting geographical information to eNB

R1-162533 Signalling design to support SPS activation/release in V2V Panasonic
R1-162677 Semi-persistent transmission support for SL Samsung

R1-163537 WF on SPS for V2V mode 1 Panasonic, Huawei, HiSilicon, OPPO, LG Electronics

Agreement:

- For SPS of V2V traffic for mode-1 SPS on PC5:
  - The eNB may configure multiple SPS configurations for a given UE
    - At least SPS-configuration-specific MCS (if MCS is part of the SPS-configuration) and SPS-configuration-specific periodicity can be configured
      - FFS if/which other SPS parameters can differ across the SPS-configurations
    - The eNB can dynamically trigger/release the different SPS-configurations by use of (E)PDCCH
      - Details of the trigger/release are FFS
  - Working assumption: The UE can indicate to the eNB that it does not intend to transmit data before a transmission associated to an SPS configuration
    - FFS any details of the signaling protocol
    - FFS whether eNB acknowledgment of the UE indication is needed

R1-163883 WF on radio measurement reporting LG Electronics, CATT, Docomo, ITRI, OPPO, III
Continue discussion till RAN1#85

R1-162122 SPS enhancement for V2V Huawei, HiSilicon

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R1-162269 Discussion on eNB assistant resource allocation in PC5-based V2V CATT
R1-162270 Discussion on UE reporting geo-info CATT
R1-162271 Discussion on physical layer design supporting congestion control CATT
R1-162336 Discussion on the mode-2 resource allocation for V2V Guangdong OPPO Mobile Telecom.
R1-162364 Signaling details for eNB controlled sidelink V2V communication Intel Corporation
R1-162392 Discussion on the resource allocation enhancement for sidelink-based V2V communication Fujitsu
R1-162429 Reporting of sidelink measurement to eNB NEC
R1-162481 Discussion on eNB scheduling enhancement for sidelink resource allocation LG Electronics
R1-162482 Discussion on geolocation information reporting for V2V resource allocation LG Electronics
R1-162544 An Enhanced Scheduling Request Method for V2X Spreadtrum Communications
R1-162591 Geo reporting for V2V Huawei, HiSilicon
R1-162678 Reporting geo information to eNB Samsung
R1-162733 UE reporting of geo-information Lenovo (Beijing) Ltd
R1-162820 Reporting of UE Geo-Info for V2X to the eNB Ericsson LM
R1-162828 Contents of Downlink Control Information for V2V over PC5 Ericsson LM
R1-163033 eNodeB signaling for V2V resource allocation Qualcomm Incorporated
R1-163154 Discussion on V2V Semi-Persistent Scheduling Procedure Beijing Xinwei Telecom Techn.
R1-163177 Necessity signaling between eNB and UE for PC5 based V2V NTT DOCOMO, INC.
R1-163308 Geo Based Resource Scheduling for V2V with Accurate Geographical Information GM - OnStar Europe

7.3.2.2.3 Resource pool design

R1-162120 Resource pool design for V2V Huawei, HiSilicon
R1-162272 Discussion on SA and data resource pool allocation CATT
R1-162365 Enhancements to sidelink resource pool design for V2V communication Intel Corporation
R1-162541 On resource pool design Nokia, Alcatel-Lucent Shanghai Bell
R1-162754 Discussion on number of SA transmissions for V2V Sequans Communications
R1-162991 Discussion on explicit and implicit autonomous resource allocation enhancements ITRI

R1-163613 WF on multiplexing SA and data LG Electronics, Nokia
R1-163627 WF on TDM of SA and data Samsung, Intel, Sequans
R1-163625 WF on MPR for transmission of PSCCH and PSSCH in the same subframe Intel

Agreement:

- When SA and the associated data are transmitted in the same TTI, they can be transmitted in non-adjacent RBs.

Working assumption:

- In V2V, SA resource and data resource are always FDMed from system perspective
  - If significant issues are found, can consider further supporting TDM

Agreement:

- A data pool is always associated with an SA pool.
- An RB of an SA pool in a TTI cannot be included in the associated data pool.
- An RB of an SA pool in a TTI cannot be included in another SA pool (if exists).
- Working assumption: At least an RB of a data pool in a TTI can be included in another data pool (if exists).
- An RB of an SA pool in a TTI cannot be included an un-associated data pool (if exists)

Agreement:

- The following two cases are supported:
  - SA and the associated data are transmitted in the same TTI,
  - SA and the associated data are transmitted in different TTIs
    - The scheduling timing between SA and associated data is variable
      - In UE-autonomous resource selection mode, the timing is chosen by the transmitting UE from a configurable range
      - In eNB-scheduling mode, the timing is determined by eNB
      - SA includes information about the scheduling timing

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– Note: the association does not necessarily include the case of intention of using the resources for a different TB, if any (which is FFS)

R1-162121 Variable number of transmissions for V2V Huawei, HiSilicon
R1-162273 Considerations on V2V traffic priority and relative resource allocation CATT
R1-162274 Resource pool enhancement in PC5-based V2V CATT
R1-162394 Discussion on Resource Pool for PC5 based V2V Fujitsu
R1-162410 Discussion on resource pools and resource pattern ZTE
R1-162430 Timing relation between SA and data for PC5-based V2V NEC
R1-162483 Discussion on resource pool design for PC5 based V2V LG Electronics
R1-162679 Resource pool for V2V Samsung
R1-162734 Resource pool for V2V Lenovo (Beijing) Ltd
R1-162992 Dynamic zone management in V2V service ITRI
R1-163034 Resource pool design for V2V Qualcomm Incorporated
R1-163073 Discussion on V2V resource pool design Potevio
R1-163137 Discussion on V2V Resource Pool Enhancement Beijing Xinwei Telecom Techn.
R1-163178 Discussion on Resource Pool for PC5 based V2V Communications NTT DOCOMO, INC.
R1-163306 Considerations on resource allocation mechanism for V2V Innovative Technology Lab Co.
R1-163337 Congestion control for V2V Huawei, HiSilicon

7.3.2.2.4 Scheduling assignment

R1-162275 Discussion on contents of scheduling assignment CATT
R1-162411 Discussion on SA content ZTE
R1-162827 Contents of PSCCH for V2V over PC5 Ericsson LM
R1-163035 Scheduling Assignments for V2V Qualcomm Incorporated
R1-163074 Contents of PSCCH for V2V communication Potevio

R1-162366 Control signaling design details for V2V communication Intel Corporation
R1-162414 SA and data transmission scheme for V2V ZTE
R1-162431 Resource collision detection and handling NEC
R1-162484 Discussion on scheduling assignment for PC5 based V2V LG Electronics
R1-162532 Discussion on SA to support same subframe scheduling in V2V Panasonic
R1-162642 Scheduling assignment design for V2V Huawei, HiSilicon
R1-162680 SA design for V2V Samsung
R1-162735 SA contents for V2V Lenovo (Beijing) Ltd
R1-163126 Considerations on SA content for V2V CATR
R1-163179 Discussion on enahancement of scheduling assignement in V2V communications NTT DOCOMO, INC.

7.3.2.2.5 Other

R1-162393 Prioritization-based resource allocation for sidelink-based V2V communication Fujitsu

7.3.2.3 Coexistence of PC5-based V2V operation and legacy Uu operation

Including inter-UE coexistence in the same carrier frequency, intra-UE coexistence in the same carrier frequency, and intra-UE coexistence in different carrier frequency

R1-163036 Coexistence of PC5-based V2V operation and legacy Uu operation Qualcomm Incorporated
R1-163180 Discussion on co-existence between PC5-based V2V and legacy Uu NTT DOCOMO, INC.
R1-162824 [DRAFT] LS on V2X multicarrier configuration Ericsson LM
Conclusion:

- The draft LS in R1-162824 is endorsed in principle. Further discussion offline to refine the wording. Revisit later this week – Stefano (Ericsson)

R1-163745 LS on V2X multicarrier configuration Ericsson

The LS is agreed in R1-163746, by the following updates:

- Accepting the changes in change marks
- multichannel operation for PC5 V2V
- Change reference [2] to TS 102 687

R1-163633 WF on coexistence of PC5-based V2V and WAN LG Electronics, NTT DOCOMO, ZTE
Agreement:

- The followings are supported for the purpose of coexistence between PC5-based V2V and WAN:
  - Sidelink open loop power control is re-used for SL TX for V2V
    - FFS RSRP based resource selection

- SL TX for V2V can be prioritized over WAN TX
  - FFS the details (e.g., applicability to Mode 1 and/or Mode 2, etc), especially whether existing D2D mechanism can be reused,
  - The prioritization is managable by eNB. Details FFS.
- The same receiver capability of D2D communication UEs is assumed for V2V UEs. That is, a Rx chain is available at all time to receive V2V signals without affecting WAN reception (from RAN1 perspective) when the UE is configured to receive V2V.

R1-162415	Coexistence of PC5-based V2V operation and legacy Uu operation	ZTE
R1-162485	Discussion on coexistence of PC5 based V2V operation and legacy Uu operation	LG Electronics
R1-162681	Discussions on coexistence of PC5-based V2V and legacy Uu	Samsung
R1-163338	Coexistence of PC5 V2V operation and legacy Uu	Huawei, HiSilicon

7.3.2.4 Enhancement to sidelink synchronization procedure

Low priority is given to enhancements to Rel-12/13 SLSS-based synchronization.

R1-162337	Discussion on the synchronization source priority	Guangdong OPPO Mobile Telecom.
R1-162416	Enhancement to sidelink synchronization	ZTE
R1-162682	Synchronization for PC5 based V2V	Samsung
R1-163037	Synchronization Procedure for V2V	Qualcomm Incorporated
R1-163203	Sidelink synchronization procedure supporting V2V	Nokia, Alcatel-Lucent Shanghai Bell

R1-163725 WF on SLSS ID for enabling LTE-based ITS coexistence Ericsson

Proposal:

- SL SS transmitted by a UE participating in ITS safety services in a given carrier is distinguishable from SL SS transmitted by a UE participating ITS non-safety services in the same carrier.
  - If a UE participates in both ITS safety and ITS non-safety services in a given carrier, then it transmits only SL SS associated with ITS safety
  - Other details FFS
  - Note: this is not intended to impact the working assumption on the sequence design of SL SS and the agreement on the location of SL SS
  - Note: how to capture it in the specification is up to RAN2
  - Send an LS to RAN2 – Ricardo (Ericsson)

Continue discussion till RAN1#85

R1-163628 Way Forward on SLSS for V2V PC5 Huawei, HiSilicon, Samsung, Sharp, ITRI, CATR, LG Electronics, NTT DOCOMO, Potevio

Proposal:

- For the V2V PC5 SLSS:
  - SLSS ID from GNSS timing can be defined by some reserved value(s) of the SLSS IDs:
    - FFS: the detailed reserved value(s) of the SLSS IDs
    - Notes: the reserved value(s) of the SLSS IDs can be (pre-)configured or pre-defined

Continue discussion till RAN1#85

R1-163654 WF on V2V and D2D co-existence Samsung, Huawei, HiSilicon, Sharp, ITRI

Proposal:

- SLSS should be differentiated between Rel-14 V2V and Rel-13 D2D
  - Details FFS

Continue discussion till RAN1#85

R1-163710 Way Forward on V2V PC5 timing Huawei, HiSilicon, ITRI, OPPO, CATR, Potevio, NEC, Nokia, ASB, Samsung

Proposal:

- PC5 TTI index/subframe number and frame number are derived from the UTC timing at least when GNSS is the direct synchronization reference for PC5 based V2V transmission
  - FFS: how to derive the TTI index/subframe number and frame number

Continue discussion till RAN1#85

R1-163882 Way forward on synchronization source priority NTT DOCOMO, Oppo, LGE

Agreement:

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- Whether eNB timing or GNSS timing is prioritized can be per carrier cell-specifically configured by the cell on which an UE camps
  - The carrier that UE camps on can be different carrier other than the carrier that the priority is configured
  - If the UE does not receive such a configuration, UE selects synchronization source with the same priority order as out of coverage case
    - FFS: The priority order for out of coverage case
  - Send an LS to RAN2 and RAN4 – Shinpei (DCM)

R1-163711 Way Forward on V2V PC5 sync priority for In-Coverage Huawei, HiSilicon, Potevio, NEC, Nokia, ASB, Samsung
Also supported by SONY

R1-162103 Network protection of out of coverage V2V UEs Huawei, HiSilicon
R1-162123 Timing alignment of different synchronization sources for V2V Huawei, HiSilicon
R1-162276 Synchronization enhancements in PC5-based V2V CATT
R1-162277 Discussion on physical layer design for synchronization in PC5-based V2V CATT
R1-162278 Discussion on PSBCH CATT
R1-162432 Synchronisation in V2X NEC
R1-162486 Discussion on sidelink synchronization enhancement for PC5-based V2V LG Electronics
R1-162639 Synchronization priority and timing consideration for V2V Huawei, HiSilicon
R1-162640 SLSS and PSBCH consideration for V2V PC5 Huawei, HiSilicon
R1-162643 Discussion on open issues for synchronization Huawei, HiSilicon
R1-162805 Discussion on V2V synchronization remaining issues PANASONIC
R1-162829 Distributed Synchronization Procedure for V2X over PC5 Ericsson LM
R1-162840 Sidelink Enhancement for V2X Synchronization Sharp
R1-162934 Sidelink Synchronization Procedure Enhancements for V2V Communication Intel Corporation
R1-162993 Discussion on sidelink synchronization procedure for PC5-basde V2V communication ITRI
R1-163181 SLSS Enhancements for GNSS based Synchronization NTT DOCOMO, INC.
R1-163307 Considerations on enhancement to sidelink synchronization for V2V Innovative Technology Lab Co.

7.3.2.5 Other

R1-162683 Transmission power control for V2V Samsung

7.3.3 Enhancements on Full-Dimension (FD) MIMO for LTE - *WID in RP-160623*

R1-163838 Chairman's Notes of Agenda Item 7.3.3 on Enhancements on Full-Dimension (FD) MIMO for LTE
Session Chairman (Nokia)

The document was presented by Matthew Baker from Nokia and .provides the outcomes of the FDMIMO session.
Discussion: .
Decision: The document is endorsed.

No issues to revisit on Friday

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

R1-162390 Rel.14 eFD-MIMO WID Progress Plan Samsung, Nokia Networks, CATT

7.3.3.1 Reference Signals

7.3.3.1.1 Non-precoded CSI-RS

For {20, 24, 28, 32} ports with mechanism for overhead reduction

R1-162861 General views on non-precoded CSI-RS enhancement CMCC
R1-162684 Discussions on CSI-RS enhancements for class A CSI reporting in eFD-MIMO Samsung
R1-162345 Discussion on non-precoded CSI-RS design for eFD-MIMO ZTE
R1-162806 CSI-RS Design Supporting up to 32 Antenna Ports Nokia, Alcatel-Lucent Shanghai Bell
R1-162367 Discussion on CSI-RS for Class A FD-MIMO Intel Corporation

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R1-163079 CSI-RS Design for Class A eFD-MIMO Ericsson
R1-162437 Design for Non-precoded CSI-RS for overhead reduction NEC
R1-162596 CSI-RS pattern design for up to 32 ports Huawei, HiSilicon
R1-162279 CSI-RS enhancement for {20,24,28,32} ports CATT

R1-162968 Discussion on CSI-RS port extension NTT DOCOMO
R1-163038 Enhancements on Non-precoded CSI-RS for eFD-MIMO Qualcomm Incorporated
R1-162685 Port-based CSI-RS overhead reduction Samsung
R1-162280 Discussion on CSI-RS overhead reduction CATT
R1-162395 Discussion on non-precoded CSI-RS Fujitsu
R1-162448 Aperiodic CSI-RS for non-precoded CSI-RS ZTE
R1-162487 New CSI-RS designs for eFD-MIMO LG Electronics
R1-163162 Non-precoded CSI-RS overhead reduction for FD-MIMO Intel Corporation

R1-163580 WF on enhancements for non-precoded CSI-RS LG Electronics, Ericsson, ETRI, NEC, Samsung
Agreements:

- For {20, 24, 28, 32} ports, a CSI-RS resource for class A CSI reporting is composed as an aggregation of *K* CSI-RS configurations [i.e. RE patterns].
  - The number of REs in the kth configuration $N_k \in \{4, 8\}$
    - The same $N_k = N$ can be used for all k
      - FFS whether the same $N_k = N$ for all k is the only permitted configuration
      - FFS whether the set of values of N_k might be further restricted for some numbers of CSI-RS ports
    - FFS whether a different set of N_k might apply in case of CDM4
    - FFS on including N_k=2.
  - Aim to enable the support of CSI-RS port sharing with Rel-13 and Rel-12 UEs
  - The per-port CSI-RS density is FFS based on one or more of the following alternatives:
    - FDM
    - TDM
    - Partial port
    - Partial overlapping, e.g. for 32 ports, ports 15-38 in PRB#1, ports 23-46 in PRB#2
    - Aperiodic CSI-RS with partial bandwidth
    - Measurement restriction in frequency domain
    - CDM, e.g. 2 x N_k ports transmitted in a single N_k resource
    - Other schemes
    - Note that the following are not precluded:
      - per-port CSI-RS density per PRB = 1
      - different per-port CSI-RS densities for different CSI-RS ports is not precluded

R1-163617 WF on Design Principles for {20, 24, 28, 32} ports NZP CSI-RS resource in Rel-14 Qualcomm, Intel, Xinwei, ZTE
Proposal:

- The aggregation of CSI-RS resource configuration is used to support {20, 24, 28, 32} NZP CSI-RS ports
- Backward compatibility with Rel-13 and Rel-12 UEs for CSI-RS port sharing shall be supported
- The use of CDM-length 2 and 4 is maintained for {20, 24, 28, 32} CSI-RS ports
  - The CDM-length 8 is not precluded. Details FFS.
- FFS on lower density and overhead reduction techniques

R1-163457 WF on CSI-RS RE density for non-precoded CSI-RS Samsung, Nokia, Alcatel-Lucent Shanghai Bell, NEC, LGE, ZTE, ETRI, NTT DOCOMO, Huawei
Revision of R1-163616
R1-163549 WF on additional REs for Class A NZP CSI-RS resource Intel

7.3.3.1.2 Beamformed CSI-RS

More efficient resource utilization for UE-specific BF CSI-RS, including aperiodic CSI-RS

R1-162686 Specification impact of aperiodic CSI-RS Samsung
R1-162599 Efficient utilization of BF CSI-RS Huawei, HiSilicon
R1-163039 Enhancements on Beamformed CSI-RS for eFD-MIMO Qualcomm Incorporated
R1-162368 On possible approaches to CSI-RS overhead reduction for Class B FD-MIMO Intel Corporation

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R1-162281 On aperiodic CSI-RS transmission CATT
R1-162807 Proposals for Improving RS Utilization for beamformed CSI-RS Transmission Schemes Nokia, Alcatel-Lucent Shanghai Bell

R1-162346 Enhancements on Beamformed CSI-RS ZTE
R1-162488 Enhancements on beamformed CSI-RS including aperiodic CSI-RS LG Electronics
R1-162969 Discussion on Aperiodic CSI-RS NTT DOCOMO
R1-162987 Discussion on resource utilization for UE-specific BF CSI-RS ITRI
R1-163134 Considerations on Aperiodic CSI-RS Beijing Xinwei Telecom Techn.

R1-163582 WF on enhancements for aperiodic CSI-RS LG Electronics, NTT DOCOMO, Samsung, ZTE
Proposal:

- Aperiodic NZP CSI-RS resource is supported in Rel-14, where
  - It can only be configured for PUSCH based A-CSI reporting.
  - Two types of CSI-RS resource configurations are supported:
    - Type 1: Reuse of legacy (semi-static) CSI-RS resource allocation/configuration
    - Type 2: A new aperiodic CSI-RS resource allocation/configuration
      - Without *Subframe_config*
      - Whether aperiodic CSI-RS resource allocation/configuration (e.g. # of ports, CSI-RS pattern, port subset) is semi-static or dynamic or a combination between semi-static and dynamic is FFS
      - Note: If resource allocation/configuration is fully semi-static, no extra bit in the UL-related DCI is needed to support aperiodic CSI-RS
  - Aperiodic CSI-RS transmission instance is indicated by UL-related DCI:
    - For Type 2, aperiodic CSI-RS transmission is in the same DL subframe as the associated UL-related DCI
    - For Type 2, aperiodic CSI-RS can be transmitted in any DL subframe that the UL-related DCI can be present.
  - Other alternatives, e.g., indicated by DL-related DCI, are FFS.
- Details on rate matching needed due to aperiodic NZP/ZP CSI-RS transmission(s) are FFS.
- FFS: Aperiodic CSI-IM resource is supported in Rel-14.

R1-163618 Way Forward on overhead reduction for Class B Beamformed CSI-RS Qualcomm, Intel, Ericsson, Xinwei
Agreements:

- Until RAN1#85, down-selection/merge the following alternatives for reducing the overhead for beamformed CSI-RS, considering overhead reduction, performance, backward compatibility, UE implementation complexity:
  - Alt.1: Aperiodic CSI-RS
    - E.g., One-shot CSI-RS transmission with transmission on the same subframe as triggering subframe
  - Alt.2: Dynamic CSI-RS activation and/or deactivation
    - E.g., One-shot or multi-shot CSI-RS transmission after the triggering subframe
  - Alt.3: Reduced frequency density via decimation over part or all of the bandwidth
  - Alt.4: MR with dynamic sharing of the beams on CSI-RS resources among the UEs
  - Alt.5: Triggered measurement of one of multiple CSI-RS configurations
  - Alt.6: Spatially multiplexed beamformed CSI-RS
  - Other approaches are not precluded

R1-163546 WF on overhead reduction for Class B FD-MIMO with K = 1 Intel, Nokia, ASB

7.3.3.1.3 Uplink DM-RS

Evaluate and, if needed, specify more orthogonal ports with partially overlapping BW allocations
R1-162282 Discussion on UL DMRS enhancement CATT
R1-162347 Discussion on UL DMRS enhancement for eFD-MIMO ZTE
R1-162369 Uplink DM-RS enhancements for FD-MIMO Intel Corporation
R1-162438 Discussion on uplink DM-RS enhancement NEC
R1-162489 Discussion on uplink DMRS enhancements for eFD-MIMO LG Electronics
R1-162601 Uplink DMRS enhancement to support more orthogonal partial overlapped ports Huawei, HiSilicon
R1-162687 Discussion on uplink DMRS for partially overlapping bandwidth allocations Samsung
R1-162808 Proposals of Evaluation Assumptions of UL MU-MIMO for FD-MIMO Nokia, Alcatel-Lucent Shanghai Bell
R1-162809 Motivation and Initial Evaluation Results of UL DMRS Enhancement Nokia, Alcatel-Lucent Shanghai Bell
R1-163040 Improving Uplink DM-RS Orthogonality for MU-MIMO Qualcomm Incorporated

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R1-163135 Discussion on uplink DM-RS enhancement Beijing Xinwei Telecom Techn.

R1-163602 WF on UL DMRS Intel Corporation, Nokia, Alcatel-Shanghai Bell, Samsung, CATT
Also supported by NEC
R1-163834 WF on Uplink DMRS Intel, Samsung
Also supported by Nokia & ASB

Agreements:
- Evaluation assumptions on Slides 2 and 3.

Conclusions:
- Consider the following possible DMRS enhancements in the evaluation:
  - IFDMA DMRS with a comb number of 2 and/or 4
  - More DMRS symbols (with or without larger OCC), e.g.:
    - IFDMA DMRS subcarriers with PUSCH REs, or
    - across 2-subframe pairing
  - Enhancement of DMRS sequence generation, including DMRS transmitted in a wider BW than the associated PUSCH
  - Frequency domain OCC
- Other solutions are not precluded
- Companies are to state their Rel-13 baseline scheme.

7.3.3.2 CSI Reporting

R1-162688 Discussions on periodic CSI reporting for class A in eFD-MIMO Samsung

7.3.3.2.1 Non-precoded CSI-RS codebooks

For newly defined number of ports for NP CSI-RS for a subset of possible port layouts,both 1D and 2D

R1-162283 Antenna port layouts for Rel-14 FD-MIMO CATT
R1-162284 Codebook design for {20,24,28,32} ports CATT
R1-162348 Discussion on rank 1-2 codebook design for eFD-MIMO ZTE
R1-162490 Discussions on codebook design for eFD-MIMO LG Electronics
R1-162597 Discussion on codebook design for up to 32 CSI-RS ports Huawei, HiSilicon
R1-162689 View on class A codebook extension Samsung
R1-162810 Codebook Design Supporting Antenna Configurations Up to 32 Ports Nokia, Alcatel-Lucent Shanghai Bell
R1-162970 Codebook enhancement for non-precoded CSI-RS NTT DOCOMO
R1-162988 Discussions of NP CSI-RS codebook for newly defined number of ports ITRI
R1-163041 Non-precoded CSI-RS Codebooks for eFD-MIMO Qualcomm Incorporated
R1-163084 Parameterization and CSI reporting for up to 32 port FD-MIMO Ericsson
R1-163186 Performance evaluation of Class A codebooks with 32 ports Intel Corporation

7.3.3.2.2 CSI reporting for hybrid CSI-RS

Hybrid between NP and BF CSI-RS or different types of BF CSI-RS

R1-162285 CSI reporting for hybrid CSI-RS CATT
R1-162690 CSI reporting for hybrid CSI-RS Samsung
R1-163042 Discussion on Hybrid CSI-RS Operation for eFD-MIMO Qualcomm Incorporated
R1-163081 Hybrid CSI Reporting Design Targets Ericsson
R1-163187 CSI enhancements for hybrid FD-MIMO Intel Corporation

R1-162349 Discussion on CSI reporting for hybrid CSI-RS ZTE
R1-162491 Discussion on CSI reporting enhancements for hybrid CSI-RS LG Electronics
R1-162598 CSI reporting mechanism for joint utilization of different CSI-RS types Huawei, HiSilicon
R1-162691 Hybrid PMI codebook and CSI reporting Samsung
R1-162692 CSI reporting for hybrid CSI-RS Samsung
R1-162811 Hybrid CSI reporting using BF and NBF CSI-RS Nokia, Alcatel-Lucent Shanghai Bell
R1-162862 Considerations on hybrid non-precoded CSI-RS and beamformed CSI-RS CMCC
R1-162971 CSI reporting for hybrid CSI-RS NTT DOCOMO
R1-163120 Discussion on Joint Utilization of Different CSI-RS Types Beijing Xinwei Telecom Techn.

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R1-163581 WF on Hybrid CSI Reporting Samsung, Alcatel-Lucent Shanghai Bell, CATT, Nokia, Qualcomm, LG Electronics, Beijing Xinwei, Interdigital, AT&T, China Telecom, Huawei, HiSilicon, CMCC, CATR
Revised in R1-163665 Samsung, Alcatel-Lucent Shanghai Bell, CATT, Nokia, Qualcomm, LG Electronics, Beijing Xinwei, Interdigital, AT&T, China Telecom, Huawei, HiSilicon, CMCC, CATR, Ericsson
(Note that slide 3 is illustrative only)

Agreements:

- Specify at least one of the following enhancements on Rel.14 CSI reporting:
  - One CSI process configured with 2 independent eMIMO-Types associated with different sets of parameters
    - Each eMIMO-Type is associated with a set of K≥1 NZP CSI-RS resources
    - Note that the 2 independent eMIMO-Types may be of the same Class
    - Note that if it decided that the two independent eMIMO-Types are always of the same class, then only 1 eMIMO-Type with 2 different sets of parameters would be sufficient.
  - An additional mechanism for CSI calculation applied to a configuration with a pair of CSI processes each of which is configured with 1 eMIMO-Type
- Notes:
  - This does not preclude the possibility of specifying a new eMIMO type in Rel-14 and the use of this new type for Hybrid CSI reporting
  - Down-selection (if any) between the two enhancements will be decided in RAN1#85

R1-163548 WF on hybrid Class A and Class B operation Intel
Revised in R1-163763 WF on hybrid Class A and Class B operation Intel, Samsung, LG

Observations:
The following alternatives have been discussed and may be studied:

- Study the following alternatives for the CSI reporting for hybrid Class A and Class B K=1 FD-MIMO and compare with the baseline of Alt 1 including i2 and CQI
  - Alt 1: Class A CSI with single i1 + RI
  - Alt 2: Class A CSI with multiple i1 + RI
  - Alt 3: Class A CSI with single i1
  - Alt 4: Class A CSI with multiple i1
  - Note for the Alt 3-4 RI can be restricted to 1
  - Note that any of the above alternatives may be reported with or without CQI and/or i2
  - Note that the CSI measurement may be based on partial or whole set of CSI-RS ports
  - Other alternatives and merging of alternatives are not precluded
- Study the following alternatives for the CSI reporting for hybrid Class B and Class B FD-MIMO and compare with the baseline of both Class Bs with full CSI
  - Alt 1: The first Class B has K>1 with CRI, and optionally i1, second Class B has K =1
  - Alt 2: The first Class B has K>1 with K independent CSI reports, second Class B has K =1
  - Alt 3: The first Class B has K=1 with PMI, second Class B has K =1
  - Alt 4: The first Class B has K>1 with CRI, and optionally i1, second Class B has K >1
  - Alt 5: The first Class B has K>1 with K independent CSI reports, second Class B has K >1
  - Alt 6: The first Class B has K=1 with PMI, second Class B has K >1
  - Other alternatives and merging of alternatives are not precluded

7.3.3.2.3 Advanced CSI reporting and interference measurement

(Second priority) Evaluate and, if needed, specify enhancements on CSI reporting to improve eNB precoding and interference measurement for MU transmissions

R1-162595 Discussion on analog CSI feedback Huawei, HiSilicon
R1-162693 Linear combination codebook and CSI reporting Samsung
R1-162812 Initial Evaluation Results with Advanced CSI Reporting Nokia, Alcatel-Lucent Shanghai Bell

R1-163454 WF on Rel.14 Advanced CSI Nokia, Alcatel-Lucent Shanghai Bell, Samsung, CATT, Huawei, HiSilicon, Qualcomm

Conclusions:

- Evaluate proposed advanced CSI schemes
- Baseline for comparison:
  - Implicit CSI feedback based on Rel.13 codebook (as well as its extension to >16 ports) or other legacy codebooks if applicable

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- Performance and feedback overhead should be provided
- Simulation scenarios:
  - FTP model 1 with 70% and 50% traffic loading
  - Evaluations should include dynamic switching between MU- and SU-MIMO
  - Other simulation details can refer to 36.897 EB/FD MIMO SI

Candidates for PMI Enhancement:

- Codebook based (implicit feedback)
  - Linear combination codebook (enhanced W2) for Non-precoded CSI-RS and beamformed CSI-RS
  - MU CSI (e.g., additional i_1, $i_{1,1}$, or $i_{1,2}$)
  - Other new or modified codebooks
- Explicit feedback
  - Channel quantization
  - Eigenvector quantization
  - Covariance matrix quantization
- Analog feedback
- Note: other schemes are not precluded

Candidates for CQI Enhancement:

- CQI Derivation
  - Interference estimation based on NZP CSI-RS
  - MU-CQI conditioned on MU hypotheses and CSI-IM
- Reduced CQI feedback delay
- Note: other schemes are not precluded

R1-162127 Discussion on enhanced CQI measurement and feedback Huawei, HiSilicon
R1-162286 On Interference enhancement for multi-user MIMO operation CATT
R1-162561 CSI Reporting for MU transmissionSony
R1-162694 Advanced CSI reporting paradigm Samsung
R1-162695 Discussions on MU CSI enhancement in eFD-MIMO Samsung
R1-162696 Discussions on interference measurement enhancement in eFD-MIMO Samsung
R1-162863 Enhancing interference measurement for MU transmissions CMCC
R1-163043 High level View on CSI enhancements for MU-MIMO Qualcomm Incorporated
R1-163080 Potential for Advanced CSI Reporting Enhancements Ericsson
R1-163185 Discussion on SINR calculation accuracy using NZP CSI-RS Intel Corporation

7.3.3.3 DMRS-based Open-Loop and Semi-Open-LoopTransmission

Evaluate and, if needed, specify necessary CSI reporting scheme and open-loop (without PMI feedback) as well as semi-open-loop (with reduced PMI feedback) transmission scheme

R1-162287 Scenarios and evaluation assumptions for DMRS-based open-loop and semi-open-loop operation CATT
R1-163456 WF on Evaluation Assumptions for DMRS based Semi-OL Samsung

Proposed modifications:

- FFS UE distribution including outdoor/indoor partitioning
- FFS UE speed
- FFS penetration loss

R1-163765 WF on Evaluation Assumptions for DMRS based OL and semi-OL Qualcomm, NEC, Beijing Xinwei, Intel
Discuss the above two proposals for scenarios and assumptions offline, and aim for a converged proposal for approval on Thur – Youngwoo - R1-163666.
Agreed in R1-163832

R1-163833 Outcome of offline session Samsung

R1-162288 Discussion on DMRS based open-loop MIMO CATT
R1-162289 Discussion on DMRS based semi-open-loop MIMO CATT
R1-162350 Discussion on DMRS-based Open-Loop and Semi-Open-Loop Transmission ZTE
R1-162370 Discussion on the enhancements for open-loop transmission schemes Intel Corporation
R1-162371 On CSI enhancements for open loop MIMO Intel Corporation
R1-162492 Discussion on OL and Semi-OL MIMO scheme LG Electronics
R1-162600 Discussion on DMRS based open loop transmission Huawei, HiSilicon
R1-162697 Discussions on open and semi-open loop transmission in eFD-MIMO Samsung
R1-162813 Initial Evaluation Results of DMRS-based open-loop transmission schemes Nokia, Alcatel-Lucent Shanghai Bell

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R1-163044	UERS-based Open-Loop and Semi-Open-Loop Transmission	Qualcomm Incorporated
R1-163083	Use Cases for (Semi-) Open Loop DMRS Transmission	Ericsson
R1-163121	Discussion on DMRS-based Semi-openloop Transmissions	Beijing Xinwei Telecom Techn.
R1-163127	Consideration on DM RS based open loop transmission	CATR
R1-163212	Need for discussions on DMRS based Open/Semi-open loop MIMO schemes for eFD-MIMO	CEWiT

R1-163455 WF on DMRS-based Open-Loop and Semi-Open-Loop MIMO CATT, Alcatel-Lucent Shanghai Bell, CATR,Intel, Huawei, HiSilicon, Nokia, Samsung

Agreement:

- Evaluate open-loop and semi-open-loop MIMO schemes until RAN1#85
  - Example schemes proposed in RAN1#84bis are provided below
  - NOTE: other schemes are not precluded
- Companies are encouraged to provide performance, CSI feedback and transmission details

Example: a CSI-process with K = 1 CSI-RS

- Alt-1a: Transparent DMRS (i.e. DMRS and PDSCH precoded identically)
  - PMI feedback points to one of N precoding hypotheses, where each precoding hypothesis corresponds to a set of M>1 precoding matrices on a subband
    - PMI overhead $\log_2(N)$ bits, where N can be 1
  - Example:
    - PRB-level or subcarrier(s)-level cycling of M precoders
    - Cycling for a subset of codebook by Codebook-subset-restriction
    - Cycling for i2, not for i1 (W1 reporting only for dual-stage codebook, e.g. Rel.10 8Tx, Rel.12 4Tx, Rel.13 Class A and its possible Rel.14 enhancements)
- Alt-1b: Non-transparent DMRS (i.e. DMRS and PDSCH precoded differently)
  - Received PDSCH signal as y = HW1W2s + n, where, S is unprecoded PDSCH, W2 refers to OL-precoding from L layer PDSCH to D DMRS ports, W1 refers to CL-precoding from DMRS/PDSCH to CSI-RS ports (or non-precoded channel)
  - RI/PMI feedback: quantization of W1, based on H and knowledge of W2
  - CQI feedback: quantization of HW1W2
  - Example of W2 precoding (open-loop)
    - Rank-1: SFBC (RE-level)
    - Rank-2: LD-CDD or layer permutation

Example: a Class B CSI-process with K>1 CSI-RS

- Alt-2a:
  - A single wideband CRI report and/or long-term PMI
  - Open-loop/semi-open-loop with K=1 is performed in the CSI-RS resource indicated by CRI
- Alt-2b:
  - CRI cycling, no CRI report
  - open-loop/semi-open-loop with K=1 is performed in the corresponding CSI-RS resource indicated by CRI

7.3.4 Downlink Multiuser Superposition Transmission for LTE - *WID in RP-160680*

R1-163839 Chairman's Notes of Agenda Item 7.3.4 on Downlink Multiuser Superposition Transmission for LTE Session Chairman (Nokia)

The document was presented by Matthew Baker from Nokia and .provides the outcomes of the MUST session.
Discussion: .
Decision: The document is endorsed.

No issues to revisit on Friday

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

7.3.4.1 Superposition transmissions

Down select between single and multiple power ratios, potential power ratios, modulation, etc.
R1-162218 Performance evaluation of MUST Category 2 with 2Tx antennas ZTE

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R1-162745 Selection of Power Ratios and Modulation for MUST PDSCH MediaTek Inc.
R1-162841 Multiple transmission power ratios for MUST Sharp
R1-163169 Discussion on candidate multiuser superposition transmission scheme NTT DOCOMO, INC.
R1-163299 On the operation and network assistance for MUST Case 1 and 2 Nokia, Alcatel-Lucent Shanghai Bell
R1-163340 Consideration on power allocations for MUST Huawei, HiSilicon

R1-163788 WF on modulation order and spec enhancement LG Electronics, Intel, MediaTek

Note:
- MUST-Near/MUST-Far UEs will be used in the relevant discussions.

Agreement:
- For Case 1 and 2 described in MUST WID,
  - MUST-Far UE's modulation order is limited at least to QPSK when it is co-scheduled with MUST-Near UE in a given subframe
    - FFS whether or not to support 16QAM for MUST-Far UEs
      - More study is necessary

R1-163776 Way forward on superposition transmission for MUST MediaTek, Huawei, HiSilicon
Agreement:
- For Case 1 & 2, up to two co-scheduled UEs per spatial layer are supported
- For Case 1 & 2, MUST category 2 with one or more transmission power ratios for co-scheduled MUST UEs in each constellation combination is supported
  - One or more transmission power ratios for each constellation combination are supported
    - FFS: The number of multiple power ratios is down-selected from 1 to 8
  - The superposed constellation corresponding to one of transmission power ratios in each constellation combination is a legacy constellation
    - For (MOD_N, MOD_F) = (QPSK, QPSK), 16QAM legacy constellation
    - For (MOD_N, MOD_F) = (16QAM, QPSK), 64QAM legacy constellation
    - For (MOD_N, MOD_F) = (64QAM, QPSK), 256QAM legacy constellation
  - If 2 or more power ratios are supported, the other multiple transmission power ratios for a MUST-far UE in each constellation combination can be selected from the following value ranges:
    - For (MOD_N, MOD_F) = (QPSK, QPSK), the power ratio range as a starting point is [0.6, 0.95]
    - For (MOD_N, MOD_F) = (16QAM, QPSK), the power ratio range as a starting point is [0.6, 0.95]
    - For (MOD_N, MOD_F) = (64QAM, QPSK), the power ratio range as a starting point is [0.6, 0.95]
  - FFS the impact if 16QAM for MUST-Far UE is supported
  - For further down-selection on the set of transmission power ratios, companies are encouraged to provide the scheduling PDF of power ratios and the corresponding performance for different sets of power ratios

Agreements:
For all MUST evaluations (cases 1, 2 & 3):
•For 2Tx & Case 1 and 2, up to two co-scheduled UEs per spatial layer are considered
•For 2Tx & Case 3, up to two co-scheduled UEs within a cell are considered
•For 4/8Tx & Case 3, up to four co-scheduled UEs within a cell are considered
Note that the above scheduling options may be considered per PRB, per group of PRBs, or per scheduled UE's bandwidth

R1-162219 Transmitter side details of MUST Category 2 ZTE
R1-162290 Selection of superposition transmission scheme and parameterization CATT
R1-162493 Discussion on power ratio and modulation order LG Electronics
R1-162848 On modulation order and power ratio for MUST China Telecommunications
R1-162879 down-selection for superposition scheme Sequans Communications
R1-163045 Superposition transmissions for MUST Qualcomm Incorporated
R1-163188 Discussion on superposition transmission Intel Corporation
R1-163301 On the specification approach of MUST Nokia, Alcatel-Lucent Shanghai Bell
R1-163335 MUST with legacy composite constellation Huawei, HiSilicon

7.3.4.2 Mechanisms for efficient operation

Related to RRC signaling, DCI, UE blind detection, etc.
R1-162291 Support of downlink superposition transmission CATT
R1-162433 MUST operational and signalling aspects NEC
R1-162494 Signaling schemes for MUST assistance information LG Electronics

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R1-162849 On downlink MUST operation mechanism China Telecommunications
R1-163046 Mechanisms for efficient operation for MUST Qualcomm Incorporated
R1-163092 Efficient MUST OperationEricsson

R1-163777 Way forward on UE assumptions for CFI in MUST MediaTek, Nokia, ASB
Also supported by Huawei, HiSi
Continue discussion offline
R1-163824 Way forward on control signaling for MUST ZTE, LG Electronics
LGE withdrew the co-sourcing
Continue discussion offline
R1-163774 Way forward on MUST mechanisms for efficient operation NTT DOCOMO, INC., MediaTek
Agreement:

- For MUST case 1 and case 2, the candidate assistance information for signalling or blind detection by the MUST-near UE include:
  - Existence of MUST interference per spatial layer
  - Transmission power allocation per spatial layer of its PDSCH and of the MUST-far UE's PDSCH
  - Modulation order of each codeword of MUST paired UE's PDSCH
    - This information is only needed if modulation order of MUST-far UEs is not limited to QPSK
- For MUST case 3, in addition to the above:
  - PMI or DMRS port/sequence of the MUST-paired UE
- Each of the above may be either:
  - per PRB, or
  - per group of PRBs, or
  - single value across the UE's scheduled bandwidth

R1-163775 Draft LS to RAN4 Mediatek
Revised and agreed in R1-163836.

R1-163797 WF on assistance information for MUST-near UE Huawei, HiSilicon, DOCOMO
Also supported by Sharp
Continue discussion offline

R1-163835 WF on DCI signalling ZTE

R1-162220 Control signaling aspects of MUST Cateogy 2 ZTE
R1-162562 Considerations of Efficient Control Signaling for MUST Sony
R1-162615 Consideration on parameter blind detection for MUST UE Huawei, HiSilicon
R1-162746 Parameters for Blind Detection in MUST MediaTek Inc.
R1-162747 Draft LS on Potential Parameters for Blind Detection in MUST MediaTek Inc.
R1-162748 Mechanisms for Operation of MUST MediaTek Inc.
R1-162881 configuration of superposition scheme Sequans Communications
R1-163170 Views on network assistance signaling for DL MUST NTT DOCOMO, INC.
R1-163189 On downlink control signalling for MUST Intel Corporation
R1-163282 Discussion on Downlink Control Signaling for MUST ASUSTEK COMPUTER (SHANGHAI)
R1-163302 On the network assistance and blind detection for MUST Case 3 Nokia, Alcatel-Lucent Shanghai Bell
R1-163303 Further details on the operation and network assistance for MUST Case 3 Nokia, Alcatel-Lucent Shanghai Bell

7.3.4.3 Evaluation for MUST using up to 8Tx

Additional evaluation methodology/assumptions, evaluation results (if needed)
R1-162221 Evaluation for MUST using up to 8Tx antennas ZTE
R1-162616 Additional evaluation methodology and assumptions for 4Tx and 8Tx Huawei, HiSilicon
R1-162749 Issues on Evaluation for MUST When Different Precoders Are Used for Near and Far Users MediaTek Inc.
R1-162864 Evaluation results for MUST using 8Tx with different precoders CMCC
R1-163300 System-level Evaluation of Case 1 and 3 MUST Nokia, Alcatel-Lucent Shanghai Bell

R1-163778 WF on additional evaluation methodology for Rel-14 MUST Mediatek, Huawei, HiSilicon
Also supported by CMCC
Agreements for System Level Evaluations:

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- Follow the UE receiver assumptions described in TR36.859
- Each company is encouraged to provide the following information together with system-level results:
  - Detailed method of link-to-system mapping applied in the system-level evaluation
  - Assumptions on CSI feedback, network assistance signalling, and blind detection
    - Note that realistic feedback should be assumed
  - Assumptions on DMRS configurations

7.3.4.4 Other

R1-162396 Discussion on enhancement for MUST Fujitsu
R1-162495 Discussion on Gray mapping for superposed constellation LG Electronics

7.3.5 eMBMS enhancements for LTE - WID in RP-160675

R1-163840 Chairman's Notes of Agenda Item 7.3.5 on eMBMS enhancements for LTE Session Chairman (Nokia)
The document was presented by Matthew Baker from Nokia and .provides the outcomes of the eMBMS session.
Discussion: .
Decision: The document is endorsed.

To revisit on Friday:
R1-163452: Scenarios and simulation assumptions for longer CP (David Bhatoolaul, Nokia):
Try to agree it quickly; if it needs more time, email approval until Friday 22nd April.

R1-163285 Work plan for eMBMS enhancements in LTE Ericsson
Decision: The document is noted.

Clarifications regarding the WID:

- Objective a may be supported on carrier on which legacy UEs can be scheduled
  - It is assumed that subframes contain a new numerology are signalled as MBSFN subframes
  - Signalling of services to legacy and new UEs is handled by higher layers, so RAN1 assumes that legacy UEs would not be configured to receive MBMS services in an MBSFN subframe that had a new numerology
  - If legacy UEs are to be supported on the carrier, the legacy control region shall not be impacted by the new numerology in a subframe
  - FFS whether MBMS MDT measurements would be impacted by any new numerology
- Objectives b and c mean that legacy UEs cannot be scheduled on the carrier
- Carriers supporting objective b may also support unicast traffic for Rel-14 UEs
- FFS what SI has to be supported on a carrier supporting objective b
- FFS whether carriers supporting objective c may also support unicast traffic for Rel-14 UEs
- FFS whether the reduced density of CRS with objectives b and c impacts time/frequency tracking, and if so, how this is handled
- Note that if there is additional RAN1 impact from objective d, it is in the area of how to support the self-contained SI as mentioned in WID

R1-163286 Skeleton TR for eMBMS enhancements for LTE Ericsson
Decision: The document is noted.
Correct the typos in TR and include the conclusion regarding objective f - R1-163451 – approved as v0.1.0 – TR number to be allocated by MCC.
Send endorsed skeleton TR to RAN2 in an LS and delegate responsibility for populating the TR to RAN2 - R1-163470 – approved in R1-163450 with the following change: "With the above conclusion, ~~there is no additional work in~~ RAN1 expects that most of the work in the objectives that are related to the study part of the work item is in the remit of RAN2."

Not treated.
R1-162736 General discussion on eMBMS enhancements Lenovo (Beijing) Ltd

7.3.5.1 Longer cyclic prefix for MBSFN subframe

Priority at RAN1#84bis is to define the required simulation assumptions.

Simulation assumptions
R1-163363 Longer cyclic prefix evaluation considerations Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted.

Note typo in table 3: 20-tap Rayleigh fading channel, plus caption relates to Scenario 2.
FFS what UE speeds need to be / can be supported.
Intel – should consider a high mobility scenario

R1-163288 Simulation assumptions for evaluation of longer CP for MBSFN subframes Ericsson
Decision: The document is noted.
R1-163163 Discussion on longer CP for MBSFN subframe Intel Corporation
Decision: The document is noted.
R1-162138 Simulation assumption and evaluation method for longer cyclic prefix Huawei, HiSilicon
Decision: The document is noted.
R1-163047 Evaluation assumptions for longer cyclic prefix Qualcomm Incorporated
Decision: The document is noted.
Offline discussion during this week to summarise the scenarios and simulation assumptions on which consensus can be reached – David Bhatoolaul (Nokia) - R1-163452 (Fri, or email approval)

Initial simulation results
R1-162137 Consideration on longer cyclic prefix Huawei, HiSilicon
Decision: The document is noted.
R1-163048 Evaluation results for longer cyclic prefix Qualcomm Incorporated
Decision: The document is noted.

Discussion
R1-163049 Design options for longer cyclic prefix for MBSFN subframes Qualcomm Incorporated
Decision: The document is noted.
R1-163287 Implications of longer CP for MBSFN subframes Ericsson
Decision: The document is noted.

7.3.5.2 Increased number of MBSFN subframes per radio frame

R1-163289 Radio frame design for extended MBSFN subframe allocation Ericsson
Decision: The document is noted.
R1-163364 Additional subframes for MBSFN usage considerations Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted.
R1-163050 Increased number of MBSFN subframes per radio frame Qualcomm Incorporated
Decision: The document is noted.
R1-162139 Consideration on increasing amount of MBSFN subframes Huawei, HiSilicon
Decision: The document is noted.

7.3.5.3 Study support for standalone eMBMS carrier

R1-163365 Standalone eMBMS carrier considerations Nokia, Alcatel-Lucent Shanghai Bell
R1-163290 Standalone eMBMS carrier Ericsson
R1-163051 Standalone eMBMS carrier Qualcomm Incorporated
R1-162620 Consideration on support for standalone MBSFN carrier Huawei, HiSilicon

7.3.5.4 Study TV transport service of UEs not being authenticated

Study whether there is any impact to the RAN1 specification by UEs receiving a TV transport service in a cell without being authenticated

R1-162621 Consideration on TV reception without authentication Huawei, HiSilicon
R1-163052 Specification impact of anonymous TV service Qualcomm Incorporated
R1-163291 RAN1 impact of supporting TV services reception for unauthenticated UEs Ericsson
Conclusion: There is no RAN1 impact from objective f
Capture this in the update of the TR

7.3.5.5 Other

7.3.6 SRS switching between LTE component carriers - *WID in RP-160676*

R1-163841 Chairman's Notes of Agenda Item 7.3.6 on SRS Carrier Based Switching for LTE Session Chairman (Nokia)
The document was presented by Matthew Baker from Nokia and .provides the outcomes of the SRS session.
Discussion: .
Decision: The document is endorsed.

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No issues to revisit on Friday

R1-162587 **Work plan for SRS switching WI Huawei, HiSilicon**
Decision: The document is noted.

7.3.6.1 General Operation of SRS Carrier Based Switching

Develop general mechanism.

R1-163211 **Scenarios and requirements on SRS switching** **SoftBank Corp.**
Decision: The document is noted.
R1-163166 **Discussion on SRS carrier based switching** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
R1-162585 **General Operation of SRS Carrier Based Switching** **Huawei, HiSilicon**
Decision: The document is noted.
R1-162737 Discussion on SRS carrier switching Lenovo (Beijing) Ltd
R1-162769 **On General Operation of SRS Carrier Based Switching** **Ericsson**
Decision: The document is noted.
R1-162770 **[DRAFT] LS on SRS carrier switching interruption time** **Ericsson**
Decision: The document is noted. Approved in R1-163453 with the following changes:
RAN1 expects that there will be changes to the interruption time requirements due to the introduction of SRS carrier based switching and would like RAN4 to:

- ~~Provide the applicable~~ RF retuning time and interruption time (in terms of µs rather than subframes) due to SRS carrier based switching considering ~~at least the following~~
  - Inter-band CA, Intra-band CA and combination of intra- and inter-band CA
  - ~~Frame structure type 2 and frame structure type 3~~
  - ~~Different or same TAG~~
  - ~~Antenna switching~~
  - ~~Number of supported carriers at the UE~~
- Inform RAN1 whether~~Is~~ it is possible to apply SRS based carrier based switching between any carriers
- ~~Study~~ Inform RAN1 ~~if~~ whether there is any impact to DL reception in the UE due to the application of SRS carrier based switching

Note that since the feature is intended to support reciprocity based channel estimation, the antenna or antennas used for SRS switching should be the same as used for DL reception on the given CC.

R1-162292 Discussion on carrier based SRS switching CATT
R1-163053 General operation of SRS switching Qualcomm Incorporated
R1-163054 Draft LS on switching time for SRSQualcomm Incorporated
R1-163614 Way Forward on SRS carrier based switching Huawei, HiSilicon, Qualcomm, Softbank
Decision: The document is noted.

Agreement:
Design Principles for SRS carrier based switching:

- SRS carrier based switching support should follow these general guidelines:
  - Applicable for deployment scenarios that have a TDD CC without the capability to have the corresponding UL CC configured
    - FFS: For eIMTA
  - Strive to reduce negative impacts on other transmissions and reception, especially UCI
  - Take into consideration switching times

Agreements:

- SRS switching solution(s) should be applicable to any TDD UL-DL configurations and special subframe configurations.
- SRS switching solution(s) should be applicable to any combination of UL-DL and special subframe configurations among CCs that are not prevented for other reasons
- The solution should not require to introduce any new TDD UL-DL configuration or special subframe configuration

7.3.6.2 Specification Impacts to Support SRS Carrier based Switching

Focus is on identifying more detailed specification changes / enhancements in order to support SRS carrier based switching
R1-163055 Specification impact of supporting SRS switching Qualcomm Incorporated
Decision: The document is noted.
R1-162586 Specification Impacts to Support SRS Carrier based Switching Huawei, HiSilicon

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Decision: The document is noted.
R1-162698 SRS Carrier Switching Aspects Samsung
R1-162771 Specification Impacts to Support SRS Carrier based Switching Ericsson
Decision: The document is noted.

Conclusions:
Potential standards impacts to consider include:
- Configurations for SRS on TDD CCs without PUSCH
- SRS switching indication signaling
  - FFS: RRC or L1 or both
- Collision handling
- FFS: Possible new symbol positions for SRS
- Power control for SRS on TDD CCs without PUSCH
- Timing advance for SRS on TDD CCs without PUSCH
- FFS: Which of periodic and/or aperiodic SRS is supported, and corresponding details/enhancements

7.3.6.3 Other

7.3.7 Further Indoor Positioning enhancements for UTRA and LTE - *WID in RP-160538*

R1-163894 Chairman's Notes of Agenda Item 7.3.7 on IndPos_enh Ad-hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm and .provides the outcomes of the IndPos_enh session.
Discussion: .
Decision: The document is endorsed.

R1-163283 Considerations on Distributed Antenna System (DAS) Scenario for Indoor Positioning China Unicom
Decision: The document is noted.

7.3.7.1 OTDOA Enhancements

R1-162606 Discussion on the same PCI case for OTDOA enhancements Huawei, HiSilicon
Decision: The document is noted.
R1-162935 On OTDOA enhancements Intel Corporation
R1-163056 Introduction of OTDOA enhancements for the shared Cell-ID scenario Qualcomm Incorporated
R1-163057 Draft CR Introduction of OTDOA enhancements for the shared Cell-ID scenario Qualcomm Incorporated
R1-163551 WF on sorting out the options for OTDOA enhancements Huawei, HiSilicon
Decision: The document is noted.

Agreement:
- As a starting point for Rel-14 WI, RAN1 decides to prioritize the following:
  - OTDOA enhancements for the same PCI:
    - Support positioning related reporting by a UE corresponding to the respective PRS muting pattern per TP
    - Support virtual cell ID per TP
      - FFS: How to generate PRS sequence /v_shift with the virtual cell ID per TP until RAN1#85

R1-162874 Further details on PRS pattern enhancement Ericsson
Decision: The document is noted.
Discuss further till next meeting
R1-162875 Richer RSTD reporting for OTDOA enhancements Ericsson
Decision: The document is noted.
R1-162876 Adaptive RSTD measurement reporting for OTDOA enhancements Ericsson
Decision: The document is noted.
R1-163058 Introduction of UE inter-frequency RSTD calibration accuracy reporting Qualcomm Incorporated
Decision: The document is noted.
Further discussion offline

7.3.7.2 PRS-based Beacons

R1-163059 Introduction of PRS based Terrestrial Beacon Systems Qualcomm Incorporated
Decision: The document is noted.
Further discussion offline

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7.3.7.3 E-CID Enhancements

R1-162607 **Discussion on the same PCI case for E-CID enhancements** **Huawei, HiSilicon**
Decision: The document is noted.
R1-162608 **Discussion on the UE Rx-Tx measurement over multiple serving cells** **Huawei, HiSilicon**
Decision: The document is noted.
Further discussion offline
R1-162877 **E-CID Enhancement for Indoor Positioning** **Ericsson**
Decision: The document is noted.
Further discussion offline

7.3.7.4 Other

R1-162878 Indoor/Outdoor Classification for Indoor Positioning Enhancement Ericsson

7.3.8 Uplink Capacity Enhancements for LTE - *WID in RP-160664*

Specification of 256QAM in uplink transmission, with focus on the design of MCS table, 256QAM related signalling, and UE category. In addition, specify support of UL PUSCH in special subframe (the work starts from Q3 2016).

R1-163842 **Chairman's Notes of Agenda Item 7.3.8 on Uplink Capacity Enhancements for LTE Session Chairman (Nokia)**
The document was presented by Matthew Baker from Nokia and .provides the outcomes of the UpCap session.
Discussion: .
Decision: The document is endorsed.

To revisit on Friday:
R1-163463 LS to RAN4 on 256QAM support per band & band combination - (Klaus, Nokia)
- should be quick to approve.

R1-163344 Work Plan for the UL Capacity Enhancement for LTE WI Ericsson, CMCC
Note – according to the WID agreed by RAN plenary, work on PUSCH in UpPTS will not start until Q3 – hence companies are welcome to submit contributions earlier but there will not be an agenda item or online discussion before Q3.

Constellation
R1-163269 Non-uniform 256QAM for UL Capacity Enhancement Sony

R1-163650 WF on UL 256QAM modulation mapping Huawei, HiSilicon, CATR, Nokia, Alcatel-Lucent Shanghai Bell, Ericsson
Agreement:
Re-use the modulation mapping in section 7.1.5 of 36.211 for UL 256QAM

MCS & TBS tables
R1-163347 Physical Layer Design Aspects of UL 256QAM Ericsson
Agreements:
- Assume the same number of bits for the MCS field in the DCI message to support UL 256QAM as it is currently, i.e. 5 bits
- MCS table supporting UL 256QAM can only be used in the UE specific search space for DCI format 0 and DCI format 4, and any new UL DCI format introduced for LAA, when the CRC is scrambled with C-RNTI
  - FFS whether the configuration of the UL 256QAM MCS table can be done separately for DCI formats 0 and 4
  - Configure the use of the MCS table for UL 256QAM separately per uplink power control subframe set
- Introduce Qm corresponding to 256QAM for UL at applicable places in the specification
- UL 256QAM and DL 256QAM are configured independently.

R1-163060 Discussion of UL 256QAM Qualcomm Incorporated

R1-162865 Discussion on UL 256QAM design CMCC
R1-162624 TBS table design for UL 256QAM Huawei, HiSilicon

R1-163346 On the Performance of UL 256QAM Ericsson
R1-163345 MCS Table Design for UL 256QAM Ericsson
R1-162140 MCS table for UL 256QAM Huawei, HiSilicon
R1-163696 Discussion on standardization impacts of UL 256QAM Intel Corporation

Sections 2.1
Revision of R1-162372
R1-162787 On 256QAM UL MCS Table design Nokia, Alcatel-Lucent Shanghai Bell

R1-163690 WF on UL 256QAM Ericsson, Nokia, Alcatel-Lucent Shanghai Bell
R1-163652 WF on UL 256QAM MCS table Huawei, HiSilicon, CATR, ZTE

Agreements:
- The minimum TBS index for 16QAM is 11
- The minimum TBS index for 64QAM is 20
- The minimum TBS index for 256QAM is 30
- 3 entries are reserved for retransmissions
- The number of PUSCH MCS entries to support 256QAM is down-selected between
  - Alt 1: 6
  - Alt 2: 5
  - Alt 3: 4

R1-163651 WF on UL 256QAM TBS table Huawei, HiSilicon, CATR, CMCC, China Unicom, China Telecom, ZTE, Deutsche Telekom, Sprint
Also supported by AT&T.

Agreements:
- Reference number of REs available in PUSCH for UL 256QAM TBS design is 144 REs/PRB
- The maximum coding rate for PUSCH with 256QAM should not exceed 0.931
- FFS whether or not to introduce new TBS index(es) for PUSCH with 256QAM
  - Companies are encouraged to submit evaluations to RAN1#85

EVM
R1-163061 Initial link level evaluation results for UL 256QAM Qualcomm Incorporated
RAN4 is assumed to be already doing this work.

UE categories
R1-162622 Discussion on UE categories with introduction of UL 256QAM Huawei, HiSilicon
R1-162786 On 256QAM UL UE categories and UE capability signalling Nokia, Alcatel-Lucent Shanghai Bell
R1-163348 UE Category and UE Capability Support for UL 256QAM Ericsson
R1-163696 Discussion on standardization impacts of UL 256QAM Intel Corporation
Section 2.3
Revision of R1-162372

R1-163708 WF on UL 256QAM UE capabilities Nokia, Alcatel-Lucent Shanghai Bell, Ericsson
Agreements:
- Introduce at least 3 new UL UE categories achieving peak data rate for 256QAM PUSCH
  - Based on UL UE category 5
  - Based on UL UE category 13
  - Based on UL UE category 14
  - FFS: Based on UL UE category 8

Note: the 256QAM UL peak data rate is around 30-40% higher than the base categories listed above.
- Extend the UL/DL UE category combinations in TS 36.306 to include for each current DL UE category paired with a 64QAM UL UE category a new combination with the respective enhanced 256QAM UL UE category
  - A UE signalling a 256QAM category shall also signal its base category
- UE 256QAM UL support/capability can only be indicated by a UE belonging to the new UL UE Categories achieving 256QAM UL peak data rate (i.e. ue-CategoryUL >14).
- Send an LS to RAN4 to ask for their input on whether the 256QAM support should be per UE or per band & band combination - R1-163463 (Klaus, Nokia)

Note that RAN1 assumes that UE capability signalling details are up to RAN2.

7.3.9 Study on LTE-based V2X Services - *SID in RP-160657*

R1-163895 **Chairman's Notes of Agenda Item 7.3.9 on V2X Ad-hoc chair (Qualcomm)**
The document was presented by Wanshi Chen from Qualcomm and .provides the outcomes of the V2X session.
Discussion: .
Decision: The document is endorsed.

Email approval for a TP (to be prepared by Hanbyul, LGE) capturing the agreements/conclusions below until 4/22/2016.

7.3.9.1 Evaluation results

To collect the evaluation results to be included in TR36.885

7.3.9.1.1 Uu transport for V2V, V2P, and V2I/N

Including evaluation of the feasibility in terms of meeting latency requirements, network coordination required, resource efficiency, and energy efficiency of UE

R1-162373 Performance analysis of Uu transport for V2V communication Intel Corporation
R1-162496 Evaluation results on the enhancement of Uu transport for V2V LG Electronics
R1-162497 Evaluation results on the feasibility of Uu transport for V2P and V2I/N LG Electronics
R1-162834 Simulation Results for Uu-Based V2V Ericsson LM

7.3.9.1.2 PC5 transport for V2P and V2I/N

Including potential V2V performance degradation

R1-162293 Evaluation results on PC5-based V2I CATT
R1-162294 Evaluation results on PC5-based V2P CATT
R1-162417 Evaluation results for LTE-based V2X ZTE
R1-162498 Evaluation results on PC5 transport for V2P and V2I/N LG Electronics
R1-162699 Evaluation results for PC5 based V2P and V2I/N Samsung
R1-163062 PC5 for V2V and V2P Qualcomm Incorporated
R1-163183 Evaluation of PC5 transport for V2P/V2I/I2V communications NTT DOCOMO, INC.

7.3.9.1.3 Other

7.3.9.2 Support of Uu transport for V2V, and PC5/Uu transport for V2I/N and V2P

7.3.9.2.1 Enhancement to multi-cell multicast/broadcast

Including optimization on set of cells performing the same multicast/broadcast and multicast/broadcast transmission based on PDSCH/PMCH

R1-163182 Evaluation of Uu transport for V2x communications NTT DOCOMO, INC.
R1-162374 Discussion on multi-cell multicast/broadcast enhancements for V2V communication Intel Corporation
R1-162499 Discussion on potential enhancements for multi-cell multicast/broadcast LG Electronics
R1-162124 Uu DL enhancements for V2X Huawei, HiSilicon
R1-163063 System level performance using SC-PTM and eMBMS Qualcomm Incorporated

R1-163604 WF on enhancements for multi-cell multicast/broadcast LG Electronics, CATR, CMCC, Deutsche Telekom, General Motors, ETRI, Fujitsu, Huawei, HiSilicon, III, ITL, KRRI, KT Corporation, LG Uplus, OPPO, Samsung, SK Telecom, Xinwei, ZTE

Conclusion:

- RAN1 has observed performance benefit with the following enhancements to DL multicast/broadcast :
  - Dynamic scheduling for multicast/broadcast transmissions
    - I.e., PDCCH-based scheduling of TBs associated to a TMGI
  - Semi-static scheduling for multicast/broadcast transmissions
  - Use of DM-RS based transmission scheme from multiple TPs including reception for idle UEs
    - This does not imply introduction of any new TM
  - DMRS-based single-cell multicast
  - PDSCH transmitted from multiple TPs
  - CRS based PDSCH/PDCCH transmitted from TP(s) that differ from the TP(s) transmitting the system information
  - DMRS based PDSCH/EPDCCH transmitted from different TP(s)
  - Use of normal CP
  - HARQ feedback
  - CSI feedback
  - Note 1: Gain, complexity, and specification impact of each enhancement are expected to be different.
  - Note 2: some enhancements may be possible without spec impact.
  - Note 3: Network/UE complexity has not been studied in RAN1.
  - Note 4: some enhancement(s) listed above may assume some level of inter-TP coordination, which does not necessarily result in spec changes

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  - Note 5: some enhancement(s) listed above may be based on contribution(s) from a limited number of company or companies
- RAN1 is still continuing study at least some of the above enhancements
- The above is to be captured in the TR
- Send LS to RAN2 to inform the following feature is beneficial from RAN1 viewpoint:
  - UE identifies which broadcast transmissions (e.g., TMGI) are relevant to it, e.g., depending on the position of the UE.

R1-163860 LS on DL broadcast/multicast for V2X LGE

The LS is endorsed, and agreed in R1-163862.

R1-163701 Way Forward on DL enhancement for Uu-based V2X Huawei, HiSilicon, Ericsson

R1-162418 Multi-cell multicast/broadcast for V2V ZTE
R1-162700 PDSCH-based enhancements for V2X multicasting Samsung
R1-163339 Uu DL enhancements for V2X Huawei, HiSilicon

7.3.9.2.2 Enhancements to unicast

Including UL enhancement (e.g., SPS enhancement, SR enhancement)

R1-162419 Uu transport enhancement for V2X ZTE
R1-162500 Discussions on UL enhancements for V2X LG Electronics
R1-162563 SR enhancements on uplink unicast for V2X services Sony

R1-163603 WF on UL SPS for Uu Ericsson, Huawei
R1-163827 Harmonized WF on UL SPS for Uu and PC5 Ericsson, Huawei, LGE, Panasonic

7.3.9.2.3 Enhancements to sidelink

Including identification of the case requiring further enhancements over PC5-based V2V and complexity of supporting transmission of pedestrian UEs

R1-162831 Uu Enhancements for V2X Ericsson LM

R1-163634 WF on PC5-based V2P/P2V LG Electronics, NTT DOCOMO, Ericsson

Conclusion:

- The following observations are made in PC5-based V2P/P2V.
  - The scenario of P-UE TX to V-UE RX is more battery efficient than the scenario of V-UE TX to P-UE RX
    - Note: this observation is made based on evaluations from a limited number of companies
    - Analysis result of P-UE power consumption based on figure 1 in R1-163062 (details to be discussed during TP preparation) is captured in TR 36.885.
  - For the purpose of for P-UE TX to reduce the power consumption and UE complexity, at least the followings are beneficial:
    - Random resource selection.
    - FFS Sensing operation during a limited time

R1-163854 WF on DSRC/LTE-based ITS Coexistence Ericsson

Conclusion:

- The LS reply from RAN1 to RAN for LTE/DSRC coexistence includes in principle the points:
  - RAN1 has discussed co-existence between DSRC and LTE-based ITS (sidelink) for safety ITS. RAN1 believes that ITS systems are important and should protect each other and in particular safety ITS.
  - Technology neutrality is essential in order to enable choice of most suitable radio technology for each ITS service as well as to enable a technology phasing in the future (e.g., towards 5G)
  - RAN1 believes that technology neutrality is enabled by describing common coexistence rules that are followed by all potential ITS technologies. Such rules may be specific for a certain region. RAN1 believes that the details of the common coexistence rules are out of RAN1 scope and should be discussed in relevant SDOs in each region.
  - For deployment of PC5-based LTE-V2V and 802.11p in the same geographical area, the ideal option is when they use different frequency channels. Note that co-deployment of both technologies is not likely to happen in all regions.
    - FFS in terms of providing example(s)
  - FFS other aspects

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R1-162295 Discussion on energy efficiency in PC5-based V2P CATT
R1-162420 Discussion on V2P design aspects ZTE
R1-162434 Discussion on potential issues and enhancements for V2P NEC
R1-162501 Discussions on SL enhancements for V2X LG Electronics
R1-162701 Power saving for pedestrian UE Samsung
R1-162832 Discussion on P2x-x2P Ericsson LM
R1-163184 Discussion on PC5-based V2P operation NTT DOCOMO, INC.

7.3.9.2.4 Other

R1-162421 RSU enhancement ZTE

7.3.9.3 Identification of high level coexistence approaches (long-term basis) between PC5 transport for V2V services and DSRC/IEEE 802.11p services in the same channel

R1-162502 Discussions on co-channel coeixsistence of PC5-based V2V and IEEE802.11p LG Electronics
R1-162609 Co-channel of PC5 V2V with other techniques Huawei, HiSilicon
R1-162702 DSRC co-existence with V2V Samsung
R1-162814 Coexistence approaches between different technologies for ITS services Ericsson LM
R1-163064 Co-channel coexistence between V2V and DSRC Qualcomm Incorporated

7.3.9.4 Other

7.3.10 Study on Latency reduction techniques - *SID in RP-150465*

Focus on this SI in 2Q 2016 will follow approved WF (RP-160650)

R1-162116 Discussion on enhanced frame structure for latency reduction in TDD Huawei, HiSilicon

R1-163523 Way Forward on enhanced frame structure type 2 for latency reduction Huawei, HiSilicon
The document was presented by Yongxia Lyu from Huawei.

- Enhanced frame structure type 2 is recommended to be supported for latency reduction
  - Additional subframe type(s) with symbol(s) for downlink transmission, GP and symbol(s) for uplink transmission should be supported
    - Downlink transmission includes DL control and DL data
    - Uplink transmission includes UL control and UL data
      - FFS SRS
    - FFS GP position and GP duration
  - More than 2 Downlink-to-Uplink Switch-points in a radio frame should be supported
    - FFS the number of the new Downlink-to-Uplink Switch-points in a radio frame
    - FFS the position(s) of the new Downlink-to-Uplink Switch-points in a radio frame
  - Backward compatibility should be preserved
    - Additional subframe type(s) can be used to replace a subset of the following subframe(s)
      - Alt. 1: MBSFN subframe(s) and UL subframe(s) configured to legacy UEs
      - Alt. 2: UL subframe(s) according to the UL/DL configuration indicated by SIB1
      - Alt. 3: MBSFN subframe(s) configured to legacy UEs
      - Alt. 4: DL subframes and UL subframe(s) according to the UL/DL configuration indicated by SIB1
      - FFS which alternative to be selected.
    - Special subframe(s) according to the UL/DL configuration indicated by SIB1 can be used as additional subframe type(s) for new UEs

Discussion: Also supported by Panasonic.
Decision: The document is noted. Continue offline discussions until Wednesday – (Huawei)

R1-163843 Chairman's Notes of Agenda Item 7.3.10 on Study on Latency Reduction Techniques Session Chairman (Nokia)
The document was presented by Matthew Baker from Nokia and .provides the outcomes of the Latency session.
Discussion: .
Decision: The document is endorsed.

To revisit on Friday:

1. R1-163466: Link level evaluation results (Daniel, Ericsson) – should be quick to approve.
2. R1-163664: Findings from link level evaluation results (Daniel, Ericsson) – should be quick to approve.
3. R1-163464: Link level evaluation results (Laetitia, Ericsson) – should be quick to approve.
4. R1-163718: Findings from link level evaluation results (Laetitia, Ericsson) – should be quick to approve.

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5. R1-163545: WF on sPDCCH (Zhizong, ZTE) – not urgent, and probably still no consensus – postpone to RAN1#85.
6. R1-163726: WF on sPUCCH design (Yunjung, LG) – not urgent, and probably still no consensus – postpone to RAN1#85.
7. R1-163748: WF on enhanced FS2 (Yongxia, HW) – not urgent, and probably still no consensus – postpone to RAN1#85.

(All other WFs not urgent and can wait till RAN1#85.)

7.3.10.1 Evaluation results

System and link evaluation results

Link level evaluations

R1-163517 Text proposal on link evaluation results Ericsson
Continue offline discussions until Wednesday – Laetitia (Ericsson)
Revised in R1-163719;
Revised in R1-163732
To be updated to include results from R1-163465, plus throughput results for PUSCH and PDSCH from other companies which are to be provided to Daniel (Ericsson) by 8:30am Thur at the latest (BLER curves without associated throughput results will be deleted).
Revision in R1-163466 – Friday.

R1-163720 Findings from link level evaluation results Ericsson
Revised in R1-163733 – to be updated including any comments from companies (on RAN1 reflector and to Daniel) and latest results - R1-163664 – Friday.

R1-162399	Link level evaluation of PUCCH for shortened TTI	ZTE
R1-162400	Link-level evaluation of TTI shortening for PDSCH	ZTE
R1-162401	Link level evaluation of SPDCCH for shortened TTI	ZTE
R1-162402	Link level evaluation of sPUSCH for shortened TTI	ZTE
R1-162842	Link level evaluation results of shortened TTI for CRS based PDSCH	Sharp
R1-162843	Link level evaluation results of shortened TTI for DM-RS based PDSCH	Sharp
R1-162844	Link level evaluation results of shortened TTI for PUSCH	Sharp
R1-162845	Link level evaluation results of shortened TTI for PUCCH	Sharp
R1-163066	Link-level evaluation of TTI shortening in DL	Qualcomm Incorporated
R1-163067	Link-level evaluation of TTI shortening in UL	Qualcomm Incorporated
R1-163264	Link-level Evaluation of shorter PDSCH	Nokia, Alcatel-Lucent Shanghai Bell
R1-163313	Link evaluation for PDSCH for short TTI with CRS based transmission	Ericsson
R1-163314	Link evaluation for PDSCH for short TTI with DMRS based transmission	Ericsson
R1-163315	Link evaluation for PDCCH for short TTI	Ericsson
R1-163316	Link evaluation for PUSCH for short TTI	Ericsson
R1-163317	Link evaluation for PUCCH for short TTI	Ericsson

System level evaluations

R1-162107 Performance evaluation on TTI shortening Huawei, HiSilicon
The document was presented by Yongxia Lyu from Huawei.

- Observation 1: UPT performance of 1ms TTI decreases a lot once FTP file size becomes larger than SSThresh, when TCP connection is kept for a long time.
- Observation 2: From 0ms to 10ms CN delay, the UPT gain decreases in 20MHz system.
- Observation 3: RU does not significantly affect the UPT for 500KB and 100KB, but for 12.5KB high RU brings much more UPT gain than lower RU.
- Observation 4: 2 symbols and 4 or 3 symbols TTI have significant mean UPT gain in both 10MHz and 20MHz system. 1 symbol TTI has marginal mean UPT gain for 500KB FTP file in 10MHz system. 7 symbols TTI has smaller mean UPT gain than other TTI lengths in both 10MHz and 20MHz system.
- Observation 5: Short TTI has more mean UPT gain in 120km/h than 3km/h.
  - The mean UPT gain of 2 symbols TTI in case of 3km/h and 120km/h is similar to 4 or 3 symbols TTI in 10MHz and 20MHz, but larger than other TTI length cases.
- Proposal 1: 2 symbols and 4 or 3 symbols TTI length could be further considered.

Decision: The document is noted.

R1-162536 Evaluation results on shortened TTI with dynamic overhead of control channel Panasonic
The document was presented by … from Panasonic.
Observations

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- Improvement of user throughput and reduction of packet delay by using shortened TTI. It is mainly because of short TCP ACK delay.
- The gain of File size = 100kbits is larger than it of 500kbyte
- The gain of cell 95% UPT UE and 50% UPT UE is larger than it of cell 5% UPT UE
- For very shortened TTI, overhead of RS/PDCCH would impact throughput and latency. Especially for 1-symbol TTI, the performance of UPT and latency would be quite challenging for cell-edge UEs.
- The gain of low load is larger than it of high load

Proposal 1: Different UEs may use different TTI length and it could be configured by eNB.
Proposal 2: RAN1 should discuss how to optimize overhead of RS and DCI for shortened TTI. In order to reduce overhead, shared RS among sTTIs and compact DCI could be considered.
Decision: The document is noted.

R1-162943 System-level performance evaluation for TCP throughput enhancement with dynamic TTI tuning Mediatek
The document was presented by Weidong Yang from MediaTek.

- Proposal 1: RAN 1 decides sPDCCH design, and evaluates reasonable L1/L2 control overhead, so that latency reduction gain of shortened TTI for different scenarios can be correctly evaluated.
- Observation 2: Whether dynamic TTI scheme provides significant latency reduction gain over shortened TTI scheme depends heavily on the design of shortened TTI. If shortened TTI is not so efficient, e.g., involved with a larger proportion of control overhead compared to legacy TTI, dynamic TTI schemes have a larger room to enhance latency performance.
- Observation 3: Given a scenario of longer file transmission time, e.g., low Uu throughput scenario or a larger file size, dynamic TTI schemes provide more throughput gain over shortened TTI scheme, but less throughput gain over legacy TTI scheme.
- Observation 4: With file size is small, dynamic TTI scheme has the same delay gain as that of shortened TTI scheme.
- Observation 5: As file size increases, delay gain of shortened TTI scheme and dynamic TTI scheme are reduced.
- Observation 6: The delay gain of dynamic TTI over either shortened TTI or legacy TTI is non-negative for different file size.
- Observation 7: As file size increases, dynamic TTI scheme has better delay performance than either the legacy TTI scheme or the shortened TTI scheme.
- Proposal 2: RAN 1 evaluates the feasibility of dynamic TTI schemes so as to guarantee positive latency reduction gain for shortened-TTI enabled UE.
- Proposal 3. RAN 1 includes the evaluation of dynamic TTI to the technical report of RAN 1 LATED, i.e. TR 36.881.

Decision: The document is noted.

R1-163518 Text proposal on system level results for latency reduction Ericsson
The document was presented by Laetitia Falconetti from Ericsson and suggests capturing in Annex B of the TR the system evaluation results of sTTI.
Discussion: Ericsson→ does not include all availble results to this meeting (for formatting reason).
Decision: The document is noted. Continue offline until Wednesday (Ericsson)
Wednesday
Revised in R1-163717
In case of fixed control overhead, add the following information in the note field (companies to provide this info to Laetitia):

- "Total control overhead per subframe compared to all available REs in the sTTIs [%]:"
- "Maximum number of UEs that can be scheduled per sTTI:"

Companies are asked to check 3717 and provide any comments (on RAN1 reflector and to Laetitia (Ericsson)) by 8:30am Thur.
Updated version to be agreed on Friday - R1-163464.

R1-163519 Text proposal on findings from the system level evaluation of latency reduction Ericsson
The document was presented by Laetitia Falconetti from Ericsson and .
Discussion: Ericsson→ does not include all availble results to this meeting (for formatting reason).
Decision: The document is noted. Continue offline until Wednesday (Ericsson)
Wednesday
Revised in R1-163718 - be updated including any comments from companies (on RAN1 reflector and to Laetitia) revisit on Fri.

R1-163716 Notes from offline session on system level evaluations Ericsson

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.
R1-162117 Performance Evaluation for enhanced TDD frame structure Huawei, HiSilicon

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R1-162296 Evaluation results of shortend TTI with control channel constraint CATT
R1-162375 System level evaluation of shortened TTI Intel Corporation
R1-162398 System-level performance evaluation for TTI shortening ZTE
R1-162399 Link level evaluation of PUCCH for shortend TTI ZTE
R1-163387 Link-level evaluation of TTI shortening for PDSCH ZTE
Revision of R1-162400
R1-162401 Link level evaluation of SPDCCH for shortened TTI ZTE
R1-162402 Link level evaluation of sPUSCH for shortened TTI ZTE
R1-162503 System-level simulation results for reduced TTI length LG Electronics
R1-162618 Evaluation on fast link adaptation Huawei, HiSilicon
R1-162703 SLS results of TTI shortening: Effect of FTP file sizes Samsung
R1-162704 SLS results of TTI shortening: Effect of HARQ RTT Samsung
R1-162705 SLS results of TTI shortening: Effect of UL access delay Samsung
R1-162842 Link level evaluation results of shortened TTI for CRS based PDSCH Sharp
R1-162843 Link level evaluation results of shortened TTI for DM-RS based PDSCH Sharp
R1-162844 Link level evaluation results of shortened TTI for PUSCH Sharp
R1-162845 Link level evaluation results of shortened TTI for PUCCH Sharp
R1-163065 System-level evaluation of TTI shortening Qualcomm Incorporated
R1-163066 Link-level evaluation of TTI shortening in DL Qualcomm Incorporated
R1-163067 Link-level evaluation of TTI shortening in UL Qualcomm Incorporated
R1-163072 System level evaulation with shortened TTI for joint HARQ and CQI feedback Qualcomm Incorporated
R1-163098 DL system-level performance evaluation for shortened TTI Motorola Mobility Germany GmbH
R1-163259 System-level evaluations for latency reduction in DL Fraunhofer HHI
R1-163264 Link-level Evaluation of shorter PDSCH Nokia, Alcatel-Lucent Shanghai Bell
R1-163265 System-level Evaluation of TTI Shortening Nokia, Alcatel-Lucent Shanghai Bell
R1-163312 System level evaluation of short TTI Ericsson
R1-163313 Link evaluation for PDSCH for short TTI with CRS based transmission Ericsson
R1-163314 Link evaluation for PDSCH for short TTI with DMRS based transmission Ericsson
R1-163315 Link evaluation for PDCCH for short TTI Ericsson
R1-163316 Link evaluation for PUSCH for short TTI Ericsson
R1-163317 Link evaluation for PUCCH for short TTI Ericsson
R1-163517 TP on link evaluations results for Latency Ericsson

7.3.10.2 Channel design for shortened TTI

Provide channel design including reference signals for s(E)PDCCH, sPDSCH, sPUSCH, sPUCCH, and details on multiplexing between existing non-sTTI and sTTI UEs.

R1-163515 Way forward on sPDCCH Huawei, HiSilicon, Ericsson

The document was presented by Yongxia Lyu from Huawei.

- sPDCCH (PDCCH for short TTI) needs to be introduced for short TTI.
  - Each short TTI on DL contains an sPDCCH region
    - An sPDCCH assigns a sPDSCH allocated within the same short TTI
      - The number of possible sPDSCH within an short TTI is for further study
    - An sPDCCH grants a sPUSCH
      - The number of possible sPUSCH to grant from an sPDCCH(s) within an sTTI is for further study
- Both CRS-based sPDCCH and DMRS-based sPDCCH are recommended to be supported
  - In the first sTTI of a subframe, legacy PDCCH region can be shared by CRS-based sPDCCH and legacy PDCCH;
  - In time domain, sPDCCH should be placed
    - For CRS-based sPDCCH, in first one or two symbols within a sTTI;
    - For DMRS-based sPDCCH,
      - Alt.1: in first one symbol or two symbols within a sTTI;
      - Alt.2: in all symbols within a sTTI.
  - In frequency domain, sPDCCH can be placed
    - Alt.1: in a distributed manner;
    - Alt.2: in a localized manner.
  - sPDSCH assigned by a sPDCCH can be allocated to unused REs within the sPDCCH region if sPDCCH region is not shared with PDCCH region
    - Details are for further study
  - sPDCCH is aggregated by a certain number of CCEs, where each CCE consists of 36 REs

  - For DMRS-based sPDCCH, FFS on whether sharing the same DMRS for sPDCCH and its scheduled sPDSCH or not.
- On sPDCCH monitoring region,
  - Frequency resource for sPDCCH monitoring region can be informed by eNB;
    - FFS: semi-static vs dynamic, cell-specific vs UE-specific, explicit vs implicit
- The number of maximum PDCCH BDs for UE SSs within a subframe is no more than
  - 32 for UEs not supporting UL transmission mode 2;
  - 48 for UEs supporting UL transmission mode 2.
- Two-level DCI can be considered for sTTI scheduling
  - Slow DCI is carried in legacy PDCCH region and transmitted at most once per subframe
  - Fast DCI is carried by sPDCCH and transmitted within a sTTI.

Decision: The document is noted.

Agreement:
- sPDCCH (PDCCH for short TTI) needs to be introduced for short TTI.
  - Each short TTI on DL may contain sPDCCH decoding candidates

The remaining parts of R1-163515 are for offline discussion until Wednesday – (Huawei, Ericsson)

R1-163516 Way forward on TMs for sTTI Huawei, HiSilicon, Ericsson, Mitsubishi Electric

The document was presented by Yongxia Lyu from Huawei.
- Both CRS based TMs and DMRS based TMs are recommended to be supported for sTTI transmission.
  - CRS can be used without modification to demodulate sPDSCH.
    - FFS: 4-layer MIMO using 4 CRS antenna ports.
  - It would be necessary to introduce new DMRS design(s) for sPDSCH demodulation
    - For a certain TTI length, PRB bundling may be necessary to achieve sufficient channel estimation accuracy.
    - FFS: the number of DMRS antenna ports that can be supported for a given short-TTI length.
    - The following DMRS patterns are further studied
      - CDM in time domain to design the DMRS pattern for sTTI
      - CDM in frequency domain to design the DMRS pattern for sTTI

Decision: The document is noted, modified as follows:

Agreements
- Both CRS based TMs and DMRS based TMs are recommended to be supported for DL sTTI transmission
  - No change for CRS definition
    - FFS: Supporting more than 2 layers for sPDSCHs
  - Further study is needed about DMRS design(s) for sPDSCH demodulation
    - For a certain TTI length, increased PRB bundling sizes may be necessary to achieve sufficient channel estimation accuracy.
    - FFS: the number of DMRS antenna ports that can be supported for a given short-TTI length.
    - For a certain TTI length, new DMRS design(s) may be needed

R1-163539 WF on sPDSCH LGE

The document was presented by Yunjung Yi from LGE.
- A UE is not expected to receive legacy TTI unicast PDSCH and short TTI unicast PDSCH simultaneously on one carrier
- The configured short TTI length can be different per UE
- TTI length of PDSCH can be dynamically changed

Decision: The document is noted.

Possible agreements:
- A UE is not expected to receive legacy TTI unicast PDSCH and short TTI unicast PDSCH simultaneously on one carrier
- Single short-TTI length can be configured for a UE
- The configured short TTI length can be different per UE
- TTI length of PDSCH can be dynamically changed

Continue offline discussion until Wednesday – Yunjung (LGE)

R1-163538 WF on sPUCCH design LG Electronics, Ericsson

The document was presented by Yunjung Yi from LGE.
- At least two sPUCCH formats are recommended to be supported

- One sPUCCH format for HARQ-ACK and/or SR feedback for a serving cell
  - The maximum supportable payload: Two HARQ-ACK bits + One SR
  - Intra-TTI frequency hopping is recommended to be supported
- One sPUCCH format for CSI feedback and/or multiple HARQ-ACK bits, e.g. as in CA and frame structure type 2
  - FFS: Supported payload size
  - FFS: Intra-TTI frequency hopping

Discussion: .
Decision: The document is noted. Continue offline discussion until Wednesday – Yunjung (LGE)

R1-163545 **Way Forward on sPDCCH** **ZTE, Mediatek**
The document was presented by Zhisong Zuo from ZTE.

- SPDCCH should be introduced in sTTI
  - SPDCCH is located in the first or first few OFDM symbol(s) of a sTTI
  - Frequency resource for SPDCCH should be configurable
  - Demodulation based on CRS
- Legacy PDCCH or SPDCCH can be used to schedule sPDSCH in one sTTI
- Number of blind decodes for one UE in a sTTI should be limited
- Efficient multiplexing of Data and Control, e.g. REs on the first few symbols not used for control can be used for Data

Discussion: .
Decision: The document is noted. Continue offline discussion until Wednesday – Zhisong (ZTE)

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

R1-162108	Views on TTI length	Huawei, HiSilicon
R1-162109	PDCCH design for short TTI	Huawei, HiSilicon
R1-162110	PUCCH design for short TTI	Huawei, HiSilicon
R1-162111	Discussion on DL HARQ timing for short TTI	Huawei, HiSilicon
R1-162112	Discussion on DL CRS for short TTI	Huawei, HiSilicon
R1-162113	Discussion on DL DMRS for short TTI	Huawei, HiSilicon
R1-162114	Discussion on UL RS for short TTI	Huawei, HiSilicon
R1-162115	Short TTI for UL transmissions	Huawei, HiSilicon
R1-162297	Design of sPDCCH and sPDSCH for shortened TTI	CATT
R1-162298	Design of sPUCCH for shortened TTI	CATT
R1-162299	Design of sPUSCH for shortened TTI	CATT
R1-162376	DL design aspects of TTI shortening	Intel Corporation
R1-162377	UL design aspects of TTI shortening	Intel Corporation
R1-162403	PUCCH design for shortened TTI	ZTE
R1-162404	Downlink RS in shortened TTI	ZTE
R1-162405	Downlink control channels for shortened TTI	ZTE
R1-162406	Study on PUSCH transmission in shortened TTI	ZTE
R1-162504	Reference signal for sPDCCH demodulation	LG Electronics
R1-162505	Reference signal for sPDSCH demodulation	LG Electronics
R1-162506	Time/Frequency resource of sPDCCH and sPDSCH	LG Electronics
R1-162507	Discussion on PUCCH design for HARQ-ACK in shortened TTI	LG Electronics
R1-162508	Discussion on PUCCH design for CSI in shortened TTI	LG Electronics
R1-162509	Discussion on PUSCH design with TTI shortening	LG Electronics
R1-162529	Discussion on control signaling design for reduced TTI	HTC
R1-162531	Discussion on reference signal design for shortened TTI	Panasonic
R1-162535	Multiplexing between non-sTTI and sTTI UEs	Panasonic
R1-162542	Design of UL reference signal for sPUSCH	Mitsubishi Electric
R1-162545	Discussion on DL control channel design for short TTI	Spreadtrum Communications
R1-162546	HARQ feedback for sTTI scheduling	Spreadtrum Communications
R1-162558	Discussion on channel design for shortened TTI	Sony
R1-162588	DCI design for short TTI	Huawei, HiSilicon
R1-162589	Discussion on CSI feeback for short TTI	Huawei, HiSilicon
R1-162590	Consideration on multiplexing of non-sTTI and sTTI in the same carrier	Huawei, HiSilicon
R1-162706	Downlink physical channel design for TTI shortening	Samsung
R1-162707	Uplink physical channel design for TTI shortening	Samsung

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R1-162738	Design of DL channels for shortened TTI	Lenovo (Beijing) Ltd
R1-162739	Design of UL channels for shortened TTI	Lenovo (Beijing) Ltd
R1-162788	Details of Shorter TTI operation for Latency Reduction	Nokia, Alcatel-Lucent Shanghai Bell
R1-162821	PUCCH design for sTTI	Nokia, Alcatel-Lucent Shanghai Bell
R1-162846	Shortened TTI for DL transmission	Sharp
R1-162850	Discussion on design of shortened TTI	China Telecommunications
R1-162944	Discussion on TTI shortening for TDD	Mediatek
R1-162945	Considertions on latency reduction for FDD	Mediatek
R1-162946	Control channel design for latency reduction	Mediatek
R1-162947	PUSCH Performance with short TTIs	Mediatek
R1-162963	Short-TTI PDCCH Design	InterDigital Communications
R1-162964	Short-TTI PDSCH Design	InterDigital Communications
R1-162965	Short TTI PUCCH Design	InterDigital Communications
R1-162966	Short TTI PUSCH Design	InterDigital Communications
R1-163068	DL channel design for shortened TTI	Qualcomm Incorporated
R1-163069	UL channel design for shortened TTI	Qualcomm Incorporated
R1-163099	Shortened DL TTI design	Motorola Mobility Germany GmbH
R1-163101	Support different TTI lengths for data channels and PUCCH	LG Electronics
R1-163171	DL channel designs for shortened TTI	NTT DOCOMO, INC.
R1-163172	PUCCH design for shortened TTI	NTT DOCOMO, INC.
R1-163173	PUSCH design for shortened TTI	NTT DOCOMO, INC.
R1-163210	On multiplexing of PDSCH with different TTIs and related enhancements	Intel Corporation
R1-163266	On multiplexing of sTTI with TTI in DL	Nokia, Alcatel-Lucent Shanghai Bell
R1-163267	On design of DL control channel for shorter TTI operation	Nokia, Alcatel-Lucent Shanghai Bell
R1-163268	Impact of shortened TTI on uplink transmission	ASUSTEK COMPUTER (SHANGHAI)
R1-163318	Physical layer aspects for PDSCH for short TTI	Ericsson
R1-163319	Physical layer aspects for PDCCH for short TTI	Ericsson
R1-163320	Physical layer aspects for PUSCH for short TTI	Ericsson
R1-163321	Physical layer aspects for PUCCH for short TTI	Ericsson
R1-163322	Downlink control signaling design for short TTI	Ericsson
R1-163323	Definition of DCI bit fields for short TTI	Ericsson
R1-163324	Short TTI operation with Carrier Aggregation	Ericsson
R1-163325	Evaluation and overview of enhanced frame structure 2	Ericsson
R1-163332	Discussion on PUSCH transmission in a short TTI	KT Corp.

7.3.10.3 Processing time reduction and related procedures

Discussion about processing time reduction for both DL and UL channels
Details on applicable procedures to support processing time reduction, e.g., HARQ operation

R1-162300	TDD system design for shortened TTI and related procedures for latency reduction	CATT
R1-162339	Discussion on TTI shortening	Guangdong OPPO Mobile Telecom.
R1-162407	Latency reduction for TDD	ZTE
R1-162408	Processing time reduction and related procedures	ZTE
R1-162446	Discussion on TTI shortening for DL/UL transmissions	NEC
R1-162510	Discussion on TTI shortening for TDD	LG Electronics
R1-162511	Physical layer aspect of processing time for shortened TTI	LG Electronics
R1-162534	Discussion on processing time reduction in physical layer	Panasonic
R1-162617	Processing time reduction for short TTI	Huawei, HiSilicon
R1-162708	Study on eNB and UE processing time for TTI shortening	Samsung
R1-162740	HARQ procedure for DL and UL data channels with shortened TTI	Lenovo (Beijing) Ltd
R1-162789	Processing time considerations for supporting latency reduction	Nokia, Alcatel-Lucent Shanghai Bell
R1-162790	On UL HARQ for Supporting Latency Reduction	Nokia, Alcatel-Lucent Shanghai Bell
R1-162866	Discussion on HARQ timing design for reduced TTI	CMCC
R1-163070	Processing time reduction and related procedures for DL	Qualcomm Incorporated
R1-163071	Processing time reduction and related procedures for UL	Qualcomm Incorporated
R1-163284	Discussion on HARQ Process for Slot-based TTI	ASUSTEK COMPUTER (SHANGHAI)
R1-163326	On processing time reduction and related procedures	Ericsson

7.3.10.4 Other

TDD

R1-163523 Way Forward on enhanced frame structure type 2 for latency reduction Huawei, HiSilicon
Also supported by Panasonic

Possible agreements:

- Enhanced frame structure type 2 is recommended to be supported for latency reduction

- Additional subframe type(s) with symbol(s) for downlink transmission, GP and symbol(s) for uplink transmission should be supported
  - Downlink transmission includes DL control and DL data
  - Uplink transmission includes UL control and UL data
    - FFS SRS
  - FFS GP position and GP duration
- More than 2 Downlink-to-Uplink Switch-points in a radio frame should be supported
  - FFS the number of the new Downlink-to-Uplink Switch-points in a radio frame
  - FFS the position(s) of the new Downlink-to-Uplink Switch-points in a radio frame
- Backward compatibility should be preserved
  - Additional subframe type(s) can be used to replace a subset of the following subframe(s)
    - Alt. 1: MBSFN subframe(s) and UL subframe(s) configured to legacy UEs
    - Alt. 2: UL subframe(s) according to the UL/DL configuration indicated by SIB1
    - Alt. 3: MBSFN subframe(s) configured to legacy UEs
    - Alt. 4: DL subframes and UL subframe(s) according to the UL/DL configuration indicated by SIB1
    - FFS which alternative to be selected.
  - Special subframe(s) according to the UL/DL configuration indicated by SIB1 can be used as additional subframe type(s) for new UEs

Continue offline discussions until Wednesday – Yongxia (Huawei)

R1-163748 WF on enhanced FS2 for latency reduction Huawei
Revised in R1-163856
R1-163849 Way Forward on reducing latency for TDD & FDD CMCC, Spreadtrum, CATT, Ericsson, OPPO, Mediatek, Nokia, Alcatel-Lucent Shanghai Bell, Intel, CATR, NTT DOCOMO
R1-163174 Discussion about TDD Frame Structure for Latency Reduction NTT DOCOMO, INC.
R1-162822 Considerations on shorter TTI for TDD duplex mode Nokia, Alcatel-Lucent Shanghai Bell
R1-162116 Discussion on enhanced frame structure for latency reduction in TDD Huawei, HiSilicon
R1-162117 Performance Evaluation for enhanced TDD frame structure Huawei, HiSilicon
R1-162709 TDD-specific issues on TTI shortening Samsung
R1-163325 Evaluation and overview of enhanced frame structure 2 Ericsson
R1-162944 Discussion on TTI shortening for TDD Mediatek
R1-162300 TDD system design for shortened TTI and related procedures for latency reduction CATT
R1-162407 Latency reduction for TDD ZTE
R1-162510 Discussion on TTI shortening for TDD LG Electronics

Friday

R1-163851 TDD evaluation assumptions LG

The document was presented by Yunjung Yi from LGE.

- For SLS/analysis of latency reduction for TDD
  - Legacy TDD DL/UL configuration #0,#1, and #2 can be evaluated.
  - The sets of "fixed" DL and UL subframes are assumed
    - Subframe #0 and #5 are assumed as normal fixed downlink subframe
    - Subframe #2 are assumed as uplink subframe
  - Evaluation sets include at least the followings
    - Reference set: Legacy TDD DL/UL configuration with legacy TTI
    - Set 1: full flexibility on other subframes
      - All downlink subframes are MBSFN subframes and can be replaced with additional subframe type
      - All uplink subframes can be replaced with additional subframe type
      - Special subframe can be replaced with additional subframe type
    - Set 2: full flexibility only on UL subframes
      - All downlink subframes are fixed as downlink subframes
      - Special subframes are fixed as special subframes
      - All uplink subframes can be replaced with additional subframe types
    - Set 3: keep legacy TDD DL/UL configuration
      - All downlink subframes are fixed as downlink subframes
      - All uplink subframes are fixed as uplink subframes
      - Special subframes are fixed as special subframes
  - Simulation results is recommended to include at least
    - Performance comparison of Set 3 compared to reference set
    - Performance comparison of other sets compared to Set 3
    - Comparison among different TTI lengths within the same set to evaluate the gain from TTI shortening.
  - Coexistence issue needs to be address in set 1 and set 2

Discussion: Ericsson→ not clear how the coexistence issue will be evaluated.

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Decision: The document is noted.

Miscellaneous

R1-162530 Uplink latency reduction with prescheduling HTC
R1-162581 SRS enhancements for latency reduction Mitsubishi Electric Co.

7.3.11 Other

R1-162125 Introduction of larger max TBS for TDD UL for eMTC in TS36.212 Huawei, HiSilicon, CATR, CATT, CMCC, Potevio, Spreadtrum, Xinwei
R1-162126 Introduction of larger max TBS for TDD UL for eMTC in TS36.213 Huawei, HiSilicon, CATR, CATT, CMCC, Potevio, Spreadtrum, Xinwei
R1-162136 Introduction of larger max TBS for TDD UL for eMTC in TS36.306 Huawei, HiSilicon, CATR, CATT, CMCC, Potevio, Spreadtrum, Xinwei
R1-162378 Work plan for FeCoMP study item Intel Corporation
The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

8 NR

8.1 Study on New Radio Access Technology

SID in RP-160671

R1-163103 Workplan for Study on Study on New Radio (NR) Access Technology NTT DOCOMO, INC.
The document was presented by Kazuaki Takeda from NTT dOCOMO. For information and provides initial RAN1 work plan for the NR study. Work plan shall be further updated according to the progress of the study.
Decision: The document is noted for information.
Thursday: Rapporteur will submit an updated work plan involving all WGs in the next meeting.

R1-163104 3GPP & ITU-R WP 5D Coordination on "5G" NTT DOCOMO, INC.
The document was presented by … from … and summarizes items related to 3GPP & ITU-R Working Party 5D (WP 5D) coordination on "5G". There are two on-going activities in WP 5D which would need coordination with 3GPP:

- IMT-2020 candidate technology submission.
- IMT-2020 parameters required for sharing studies in preparation for WRC-19 agenda item 1.13.

Discussion: Mr Chair→ need for a close coordination with RAN4 to reply to ITU-R. Refer to RP-160598.
Decision: The document is noted.

R1-163376 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

8.1.1 Overview of new radio interface

High level design proposals addressing all usage scenarios, requirements and deployment scenarios, e.g., eMBB, MTC and URLLC. Companies are encouraged to limit the number of papers to two per company and to three pages per contribution.

R1-162144 Flexible air interface for 5G Huawei, HiSilicon
The document was presented by David Mazzarese from Huawei.

- Proposal 1: To ensure forward compatibility for the new radio, physical layer functionalities (such as signals, channels and signaling mechanisms) specific to a service/usage scenario should be confined within its flexibly-configured time/frequency partition. Sharing of some common physical layer functionalities among some services should be supported. UEs should be able to operate properly once a new service is added and occupies subcarriers (e.g. PRBs) within the UE's system bandwidth. Therefore the new radio should not require the transmission of wideband signals and channels.
- Proposal 2: The new radio interface should be designed to support being configurable to meet the diverse requirements. This includes flexibility to configure waveforms and multiple access schemes, OFDM numerologies and frame structure, transmission protocols and channel coding/modulation schemes.

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- Proposal 3: The new radio interface should be designed to support the coexistence of different numerologies on a single continuous block of spectrum (with minimized or no guard band). Frequency localized OFDM-based waveform is one candidate technique to be studied.

Decision: The document is noted.

R1-162145 Overview of radio access mechanism for 5G Huawei, HiSilicon

- Proposal 1: In order to provide a boundary-less radio access with UE cell-centre-like experience for the new radio, RAN1 should study the following in a dense urban deployment scenario:
  - Radio access design without rigid association with a physical cell. Physical layer design that is based, as much as possible, on an identifier that can identify a UE across coverage of a logical access entity.
  - Network-oriented measurement and discovery with uplink signals to assist in UE-TRP association. Tracking mechanisms based on uplink transmissions that can minimize mobility interruption.
- Proposal 2: In order to provide low latency low overhead radio access, RAN1 should study the design of physical channels, reference signals and sequences that enable:
  - A lighter or no random access procedure for UE fast re-entry to the system
  - Uplink transmission mechanisms without dynamic request and grant.

Decision: The document is noted.

R1-162171 General design principles for 5G new radio interface: System operations Samsung

The document was presented by Younsun Kim from Samsung.

- Design principle 1: Provide specification support for both sub-6GHz and over-6GHz spectrum in 5G phase 1.
- Design principle 2: Support system bandwidth larger than 20MHz for both sub-6GHz and over-6GHz spectrums.
- Design principle 3: Support both FDD and TDD modes of operation.
- Design principle 4: Design 5G so that it can coexist with LTE when deployed on LTE spectrum.
- Design principle 5: Support forward compatibility resources on time and frequency domain resources which are not used for essential system operations.
- Design principle 6: Strive for a common structure for both sub-6GHz and over-6GHz considering different channel characteristics and target verticals.
- Design principle 7: Minimize transmissions which must occupy entire system bandwidth or always turned ON.
- Design principle 8: Strive for a common specification design to support similar set of features.

Discussion: LGE asked clarifying the figure on spectrum allocation – especially TDD allocation.
Not a Samsung's proposal – reflects current understanding, shared with RAN4

Decision: The document is noted.

R1-162172 General design principles for 5G new radio interface: Key functionalities Samsung

- Proposal 1: OFDMA is the baseline for 5G new radio DL/UL with additional consideration of SC-FDMA for UL.
- Proposal 2: Strive for minimal number of numerology sets while taking into account the different requirements on wide range of frequency spectrum, various use case, and complexities.
- Proposal 3: Consider adoption of a new channel coding scheme for 5G new radio and support LDPC as a candidate
- Proposal 4: FD-MIMO and its enhancements is the baseline for 5G new radio MIMO
- Proposal 5: Adopt joint time-varying analog and digitial beamforming (hybrid beamforming) for over-6GHz band system design.
- Proposal 6: Support reduced latency for TDD mode of operation of 5G new radio by reducing the DL-UL periodicity or by introducing dynamic TDD.
- Proposal 7: 5G new radio should support both standalone operation and non-standalone operation.

Decision: The document is noted.

R1-162192 Frequency scalable NR design from < 1GHz to mmW Qualcomm Inc.

The document was presented by Tingfang Ji from Qualcomm.

- Proposal 1: NR should be optimized for licensed/shared/unlicensed spectrum access, e.g., self-contained waveform/transactions.
- Proposal 2: NR should support different carrier frequency and/or deployment scenarios with scalable numerologies, e.g., following 2^N scaling.
- Proposal 3: mmW-specific design should be introduced to the air interface in addition to designs optimized for sub6 GHz access, e.g., support of both RF beamformed and non-beamformed broadcast/control channels.
- Proposal 4: Sub6 GHz and mmW specification should share common features that define the radio hardware envelope, e.g., channel coding, receiver MIMO processing, HARQ timeline, etc.

Discussion: Linear scaling was debated.

Decision: The document is noted.

R1-162222 Design principles of NR in RAN1 ZTE

The document was presented by Yifei Yuan from ZTE.

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- Proposal 1: Abstract (separate) some common parts from Layer1to form L0 to support all kinds of different scenarios
- Proposal 2: List some important issues that may affect compatibility especially forward compatibility
- Proposal 3: Non-orthogonality access e.g. MUSA (multi users shared access).should be considered in NR especially for mMTC/IoT

Decision: The document is noted.

R1-162238 A Dynamic TDD Radio Interface National Instruments Corp.

The document was presented by Nikhil Kundargi from National Instruments and introduces guidelines for designing a new frame structure suitable for Massive MIMO. This frame structure has been prototyped in multiple real world test beds to validate its practicability in ITU 2020 deployment scenarios. We also presented a flexible dynamic RAT to accommodate extensions of the numerology to 100 MHz channels based on this frame structure.

Discussion: on the concept of long CP (overhead issue)
Introduction of variable CP for flexibility – complexity issue to be considered

Decision: The document is noted.

R1-162301 5G New Radio Interface Design CATT

The document was presented by Fang Chen Cheng from CATT and lists the following proposals as the potential guideline of 5G interface design

- Wide range of system bandwidth
- Further enhancement of link adaptation
- Dynamic multi-antenna technologies
- Efficient support of large packets and small packets with extended coverage and power saving
- Minimized RS overhead
- Opportunistic radio access
- Variable length of TTI with self content control information
- Support central and distributed network control
- Universal frame structure for downlink, uplink and sidelink air interface design
- New waveform for asynchronous multi-subcarrier reception
- Efficient Broadcast and multicast
- Non-NR carrier embedded in the 5G carrier

Decision: The document is noted.

R1-162332 Overview of New Radio Interface Fujitsu

The document was presented by Tim Moulsley from Fujitsu.

- Proposal 1: Identify features expected to be supported in Phase 1 and Phase 2 and study designs for Phase 1 that can be forward compatible with Phase 2 (and beyond).
- Proposal 2: Investigate efficient TDD frame structure options which can achieve efficient utilization of radio resources and low latency.
- Proposal 3: Supporting enhanced inter-cell operation control for UDN should be studied (including interference control and joint transmission).
- Proposal 4: The multiple connectivity can be studied in both inter-frequency and intra-frequency cases.
- Proposal 5: Dynamic TDD can be studied for the NR.
- Proposal 6: The combination of multiple connectivity (for FDD and TDD) and dynamic TDD can be studied in NR.
- Proposal 7: Aim for a unified uplink transmission framework which is beneficial for both mMTC and URLLC scenarios.

Decision: The document is noted.

R1-162379 Overview of new radio access technology requirements and designs Intel Corporation

The document was presented by Ralf Bendlin from Intel and shows high level views on some of the important design aspects for a next generation new radio access technology including non-orthogonal multiple access, frame structure, waveform, low overhead system information acquisition, coexistence of different numerologies and services as well as channel coding.

Decision: The document is noted.

R1-162426 Consideration on the design of NR NEC Corporation

The document was presented by … from NEC.

- Proposal 1: New RAT should be highly flexible and scalable to meet diverse requirements for three usage scenarios.
- Proposal 2: New RAT should support tight interworking; DC/CA can be performed among 5G new RATs, and DC can be performed between 5G new RAT and LTE.
- Proposal 3: FDD and TDD should be considered for the carrier frequency below 6GHz, and TDD can be considered for carrier frequency above 6GHz.

Decision: The document is noted.

R1-162512 Overview of new radio interface design LG Electronics

The document was presented by … from LGE.

- Frequency-band specific design should be considered
  - Multiple set of numerologies to cover very wide range of frequencies should be supported
  - Band-specific transmission scheme should be considered.
- The new RAT system should be very flexible and dynamic
  - Always-on or periodic signaling/channel should be minimized
  - Flexible HARQ timing should be supported
  - Flexible duplex should be enabled

Decision: The document is noted.

R1-162513 Discussion on new radio design and requirements in consideration of various use cases LGE

Decision: The document is noted.

R1-162547 Some Considerations on Enabling Radio Technologies for 5G NR Spreadtrum Communications, CATR

The document was presented by Jinhui Chen from Spreadtrum.

Decision: The document is noted.

R1-162564 Consideration on multiple access for new usage scenarios Sony

The document was presented by … from Sony.

- Observation 1: There may be shortages in the resources to transmit in new usage scenarios because these scenarios are characterized by a simultaneously massive number of device connections, low latency, and high reliability capabilities.
- Proposal 1: Non-Orthogonal Multiple Access (NOMA) technology should be considered to improve the spectral efficiency for New RAT.
- Proposal 2: Not only downlink NOMA but also Uplink NOMA should be a target candidate technology.
- Proposal 3: RAN1 should consider reducing the use of user specific information in each transmit functional block to be able to easily apply NOMA technologies.

Decision: The document is noted.

R1-162567 Considerations for eMBB in the new RATETRI

The document was presented by … from ETRI.

- Tight interworking between the macro cell and the small cell should be considered.
- Mobility-related structures and functions should be considered in a high speed deployment scenario.
- The unified design of the new RAT frame structure should take both below and above 6GHz frequency bands into account.

Decision: The document is noted.

R1-162577 Flexible framework for New Radio INTERDIGITAL COMMUNICATIONS

The document was presented by Paul Marinier from InterDigital.

- Framing and numerology
  - Support for multiple TTI's and symbol durations
  - Low latency decoding
  - Low HARQ-ACK transmission delay
  - Control signaling split
- Multiplexing and scheduling
  - Orthogonal multi-carrier baseline
  - Advanced UE transmission waveform
  - Physical layer processing robust to short bursts of interference
  - UE-based scheduling within allocated pool of resources
- Deployment
  - Minimization of always-on signals
  - Blank resources
  - Flexible provision of reference signals and resources
  - Use of LTE signals in tightly integrated LTE-NR scenarios

Decision: The document is noted.

R1-162580 Overview of NR techniques Mitsubishi Electric Co.

The document was presented by … from Mitsubishi.

- Proposals related to Massive MIMO
  - User interference cancellation at transmitter: precoding/postcoding design
  - CSI reporting with higher resolution
  - Investigation on impact of realistic assumptions on channel reciprocity (i.e., mismatches
  - in RF circuit characteristics between TX and RX)
  - RS design, including SRS, to reduce pilot contamination

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Decision: The document is noted.

R1-162741 Discussion on new radio interface Lenovo (Beijing) Ltd
The document was presented by Xinghua Song from Lenovo.
- Proposal 1: Consider common/symmetric DL/UL waveform design at least for above 6GHz.
- Proposal 2: Support multiple/scalable numerologies in NR to support frequency bands up to 100GHz.
- Proposal 3: Frame structure should flexibly support eMBB/mMTC/URLLC in the carrier.
- Proposal 4: NR should keep the always-on signals as minimum as possible to achieve higher efficiency and better forward compatibility.
- Proposal 5: Ultra-dense deployments should be emphasized in the NR design and TRP coordination should be studied including inter-TRP interference management, resource coordination, joint scheduling, mobility management, etc.
- Proposal 6: Study RAN functional split and interface in different deployments and carrier frequencies considering RAN virtualization and its impact on PHY.
- Proposal 7: Provide RAN1 feedback on the RAN functional split to RAN2/3.

Discussion: RAN1 chair→ is proposal 6 also be proposed to RAN2/3? Same approach
Decision: The document is noted.

R1-162791 Overview of next generation new radio access technology MediaTek Inc.
The document was presented by … from MediaTek.
- Proposal 1: For eMBB including medium and high end MTC service, urban macro and dense urban scenarios with below ~40GHz spectrum and the wide system bandwidth are focused for optimal design.
- Proposal 2: For URLLC, small cell layer in dense urban scenario or indoor scenario with below ~40GHz spectrum is focused for optimal design.
- Proposal 3: For mMTC targeting the low end MTC service, rural scenario with below 1GHz spectrum (e.g., 700Mhz) is focused for optimal design.
- Proposal 4: Multiplexing of the different usage scenarios should be transparent for a device in system design.
- Proposal 5: The set of waveform numerologies should be restricted with the justified scenarios to reduce the UE implementation complexity.
- Proposal 6: The mechanism to support the flexible narrow band and wide band operation should be studied for UE energy efficiency.
- Proposal 7: The more advanced receiver should be considered to improve the spectrum efficiency and data throughput.
- Proposal 8: Reduction on PHY control and pilots can be considered to achieve the high performance.
- Proposal 9: A codec, achieving the high throughput with low power consumption, should be studied to meet 5G requirements with feasible implementation.
- Proposal 10: Support of flexible frame structure should be considered in the system design.

Decision: The document is noted.

R1-162867 Design principles for new radio CMCC
The document was presented by Tong Hui from CMCC.
- Proposal 1: The deployment scenarios and requirements in RAN SI "Scenarios and Requirements for Next Generation Access Technologies" should be the basic principle for new radio interface design.
- Proposal 2: Forward compatibility should be supported for Phase 1 (R15) design of new radio.
- Proposal 3: A software defined air interface including multiple air interface profiles is required to meet diverse requirements of all three usage scenarios. The AI profile should be tailored for specific service requirements and network/UE capabilities.

Decision: The document is noted.

R1-162882 Requirements for the 5G New Radio physical layer Nokia, Alcatel-Lucent Shanghai Bell
The document was presented by Karri Ranta-aho from Nokia.
- Both FDD and TDD should be supported.
- Multiple different OFDM numerologies should be supported for different deployment environments and frequency bands.
- Multiple different TTI lengths or should be supported for different latency and cell range targets.
- Support for flexible/dynamic TDD should be considered for configurations optimized for bands above 3 GHz.
- mMTC point of optimization should be around or below 1 GHz.
- Single carrier waveforms should be considered for configurations optimized for very high bands, e.g. > 40 GHz, as well as for mMTC.
- LBT mechanism should be supported for Licenced-Assisted Access.

Decision: The document is noted.

R1-162929 Overview of OTFS Waveform for Next Generation RAT Cohere Technologies, AT&T, CMCC, Deutsche Telekom, Telefonica, Telstra

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The document was presented by … from Cohere and requests that the Orthogonal Time Frequency & Space (OTFS) modulation and reference signal multiplexing scheme is thoroughly evaluated on its merits for the air interface of 5G systems and included in the Technical Report TR38.802 "TR for Study on New Radio Access Technology Physical Layer Aspects".
Decision: The document is noted.

R1-163105 Overview of eMBB opration for NR access techonology NTT DOCOMO, INC.
The document was presented by Fred Takeda from NTT DOCOMO.

- Proposal 1: Study numerology parameters for OFDM-based waveform for NR.
  - Scalable numerology parameters can be a starting point.
  - Feasibility and benefit of modified OFDM-based waveforms can also be studied.
- Proposal 2: Consider lean radio-frame with flexible dynamic TDD as a candidate radio frame design for NR.
  - Study design/procedure of dynamic subframe such that highly flexible TDD operation is enabled.
  - Study design/procedure of fixed DL subframe such that various scenarios can efficiently be supported.
- Proposal 3: Study native support for massive MIMO and/or virtual cell operations for NR.
  - Various massive MIMO operations/configurations should be investigated.

Decision: The document is noted.

R1-163129 Overviewon new air interface CATR
The document was presented by … from CATR.

- Proposal 1: eMBB, mMTC and URLLC should have the same priority to be study and specified. Fundamental physical layer signal structure design should take all three usage scenario into account
- Proposal 2: 5G NR framework should be capable to provide diverse usages in one carrier without guard band.
- Proposal 3: NR supports set of numerologies to meet all deployment scenarios.
- Observation 1: The main expected spectrum for NR will be TDD and dynamic TDD design should be supported at the very beginning.

Decision: The document is noted.

R1-163157 Requirements for New Radio Interface IITH
The document was presented by Kiran Kuchi from IITH.
Decision: The document is noted.

R1-163190 New RAT Using imparity CCFD for mMTC III
The document was presented by … from III and proposes the CCFD architecture in new RAT.

- Using the imparity CCFD with TDD, allows UL and DL be allocated in the same time and in the same bandwidth. Moreover, decide resource schedule according with the position or direction of UE can reduce the interference between UE and UE to achieve the same service coverage as non-CCFD TDD, so that we can get better performance.

Decision: The document is noted.

R1-163215 Overview of NR Ericsson
The document was presented by Stefan Parkvall from Ericsson.
Decision: The document is noted.

R1-163280 On new radio interface design targets and principles China Unicom
The document was presented by … from China Unicom and .

- Proposal 1: for design the unified air interface, reducing CAPEX and OPEX should be considered; the enabled technologies should be identified for different usage scenarios and coexistence and coordination between these technologies should be further studied.
- Proposal 2: For E2E network slicing, the key issues should be considered including how to mapping the core network slicing to radio interface slicing and how to calculate the actual bearing physical resources.

Decision: The document is noted.

R1-163292 Overviews of physical layer signal structure for New RAT Sharp
The document was presented by … from Sharp.
Observation 1:

- For downlink, OFDM-based waveform is the baseline for NR.
  - Suitable for flexible UE multiplexing in spatial and/or power domains, such as MU-MIMO and MUST.
- For uplink, both single carrier signal and OFDM-based waveform can be considered for flexible UE multiplexing.

Observation 2: Full flexible UL/DL subframe allocation is one of the key requirements for NR to support.

- The ratio of UL/DL traffic becomes more flexible based on:
  - Location, time, etc

Observation 3: UE complexity for supporting multiple 3GPP-RATs should be taken into account when coding scheme is studied

- mMTC and/or URLLC specific terminal may support only NR. In this case, mMTC and/or URLLC UE may not need to support turbo decoder.

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Decision: The document is noted.

R1-163293 Unlicensed bands support in New RAT Sharp

Observation 1: The increasing number of supported band is serious issue in terms of NR global terminal since frequency range will be dramatically increased in NR.

Observation 2:

- Unlicensed spectrum becomes more important and can be used as an "international band"
- Native support of unlicensed spectrum is one of the key requirements for NR.
  - FFS: standalone on unlicensed spectrum

Decision: The document is noted.

R1-163615 Way Forward on Ovverview of NR NTT DOCOMO, Alcatel-Lucent Shanghai Bell, Huawei, HiSilicon, Nokia, Samsung

The document was presented by Kazuaki Takeda from NTT DOCOMO.

- Largest component carrier bandwidth not smaller than 80 MHz
- Waveform is based on OFDM
  - Multiple numerologies are considered
  - A form of DFT-S-OFDM and/or OFDM with filtering/windowing is further considered
  - FFS for case where PA efficiency is an issue
- Frame structure(s) supporting
  - FDD and TDD duplex arrangement
  - Downlink, uplink, and sidelink transmission
  - Access and backhaul
  - Operation in licensed and at least licensed-assisted operation in unlicensed band
- Study flexible/dynamic TDD, including both downlink and uplink transmissions in the same subframe interval
- Study enhanced massive MIMO analog/digital/hybrid beam-forming
- Study multiple access mechanisms including UL-grant less transmission, contention-based transmission, non-orthogonal multiple access

Decision: The document is noted, modified as follows:

Agreements

- Largest component carrier bandwidth not smaller than 80 MHz for at least one numerology is supported
- Waveform is based on OFDM
  - Multiple numerologies are supported
  - Additional functionality on top of OFDM such as DFT-S-OFDM, and/or variants of DFT-S-OFDM, and/or filtering/windowing, and/or OTFS is further considered
    - Complementary non-OFDM based waveform is not precluded for some specific usecases (e.g., mMTC use case)
- Study frame structure(s) supporting at least
  - FDD duplex arrangement
  - TDD duplex arrangement
  - Downlink transmission
  - Uplink transmission
  - Sidelink transmission
  - Access link
  - Backhaul/relay link
  - Stand alone operation in licensed band
  - Non stand alone operation in licensed band
  - Licensed-assisted operation in unlicensed band
- Study flexible/dynamic TDD, including both downlink and uplink transmissions in the same subframe interval
- Study enhanced massive MIMO analog/digital/hybrid beam-forming
- Study multiple access mechanisms including UL-grant less transmission, contention-based transmission, non-orthogonal multiple access
- Study flexible duplex

Not treated.

R1-162302	Consideratoin of mMTC in 5G system design	CATT
R1-162380	Overview of antenna technology for new radio interface	Intel Corporation
R1-162567	Considerations for eMBB in the new RAT	ETRI
R1-162578	Reference signal principles for New Radio	INTERDIGITAL COMMUNICATIONS
R1-163394	Basic principles for the 5G New Radio access technology	Nokia, Alcatel-Lucent Shanghai Bell (R1-162883)
R1-163106	Overview of mMTC and URLLC for NR access technology	NTT DOCOMO, INC.

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R1-163190 New RAT Using imparity CCFD for mMTC III
R1-163215 Overview of NR Ericsson
R1-163216 Some design principles for NR Ericsson

8.1.2 Forward compatibility for new radio interface

Solutions how to achieve forward compatibility with Phase II specification and beyond.

R1-162193 Forward compatible NR design Qualcomm Inc.

The document was presented by Tingfang Ji from Qualcomm.

- Proposal 1: Waveforms for initial access and paging should have limited time/frequency footprint.
- Proposal 2: Self-contained data and mobility transactions are highly desirable, such that UE activity during a transaction is limited to confined time/frequency footprint.
- Proposal 3: Persistent signals such as CRS should be configurable based on different use cases.
- Proposal 4: Identify the characteristics for each feature/services for forward compatibility analysis
- Proposal 5: Forward compatibility signalling of blank time/frequency resources should be defined for the introduction of unknown features

Decision: The document is noted.

R1-163392 Consideration on forward compatibility for new radio interface ZTE (R1-162223)

The document was presented by Yifei Yuan from ZTE.

- Regarding frame structure, self contained frame structure, flexible data subframes and flexible numerology should be considered.
- Regarding user centric design, the design principle should be to minimize mandatory signals in the network for lower interference and better network efficiency. Reference signals should be designed in on-demand and UE specific manner. Broadcast channel for system information should include only the common and essential system information.
- Regarding MIMO framework, CSI and transmission scheme should be decoupled. We should strive for universal MIMO framework for different scenarios and use cases. Multi-level CSI feedback is considered to flexibly adapt to different CSI requirements. In additional to data channel, design of MIMO framework should also consider support of beam based control channel, broadcast channel and synchronization signal.

Decision: The document is noted.

R1-162514 Consideration on forward compatible new radio interface design LG Electronics

The document was presented by Eunsun Kim from LGE.

- Always-on or periodic signalling/channel should be minimized
- Flexible and dynamic DL/UL configuration should be supported
- Flexible HARQ timing should be supported
- New waveform of NR should provide multiplexing of different numerologies/usecases

Decision: The document is noted.

R1-162553 Forward compatibility aspect of NR Panasonic Corporation

The document was presented by Hidetoshi Suzuki from Panasonic.

- Proposal 1: Different usage scenarios are realized by sub-RATs, where certain amount of independency is achieved among sub-RATs.
- Proposal 2: The system is designed as to allow different sub-RATs to use different time/frequency resource. Overlapping among sub-RATs is subject to case-by-case discussion.
- Proposal 3: The system is designed to allow the introduction of new waveform in different time/frequency resource usage.
- Proposal 4: The system is designed to reduce the inter-sub-RAT interference (emission).
- Proposal 5: The need of sub-RAT specific synchronization signals are subject to case-by-case discussion.
- Proposal 6: The use of CRS or DMRS depends on use cases and could be different among sub-RATs.
- Proposal 7: PBCH/MIB like very initial common channels should be minimized but cell detection latency should also be taken into account.
- Proposal 8: The need of sub-RAT specific PBCH/MIB like very initial common channels is subject to case- by-case discussion.
- Proposal 9: On demand SIBs transmission or constant periodic SIBs transmission depends on the frequency of incoming UEs. Depending on the use cases, both may be required and it is sub-RAT specific.
- Proposal 10: Cell common L1 control signalling needs careful design for forward compatibility.
- Proposal 11: Signal dynamic range should be taken into account for the possibility of future compatibility among multiple sub-RATs.
- Proposal 12: Signal dynamic range should be taken into account for the flexibility on DL, UL and sidelink duplex.
- Proposal 13: Signal dynamic range should be taken into account for sharing frequencies among operators.

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Decision: The document is noted.

R1-163294 Forward compatibility for New RAT Sharp

The document was presented by John Kowalski from Sharp.

- Observation from Co-cell/site/carrier operation perspective:
  - Phase II NR should co-exist with Phase I NR on the same carrier component.
    - FFS: FDM, TDM or any other multiplexing scheme within a carrier component
    - FFS: how dynamically reallocate Phase I NR resources and Phase II NR resources
- Observation from eNB perspective:
  - Phase II NR eNB should support the connectivity to Phase I NR UE.
    - FFS: Phase II eNB support Phase I UE and Phase II UE at the same time and frequency
  - Phase I eNB should support the connectivity to Phase II UE.
    - FFS between following two alternatives
      - Alt.1: Phase II UE is mandated Phase I functionality.
      - Alt.2: Phase II NR has the backward compatibility with Phase I NR.
        - E.g. common signaling and/or air-interface
- Observation from UE perspective:
  - At least Phase I NR UE should be allowed to connect to Phase II NR eNB.
  - Phase II NR UE does not need to support all Phase I functions.
    - FFS:how to divide the feature sets for forward compatibility.
- Observation from Specification perspective:
  - From the specification perspective, UE specific physical layer parameters may provide flexible extensions of physical layer structures in Phase II even for cell specific use cases.

Decision: The document is noted.

R1-163555 WF on Forward Compatibility Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei.

Observations for forward compatibility and for compatibility of different features within each release:

- Support of Coexistence over a single continuous block of spectrum
  - NR and other 3GPP RAT (e.g. LTE, NB-IoT)
  - different NR numerologies
  - different services
- Support of multiple services (in any phase/release)
  - services using future designs (e.g. waveform, frame structure, multiple access, etc)
  - services using the same OFDM-based waveform with different numerology
- Support of accommodating new technical features
  - seamlessly integrate new device categories
  - enable UEs that do not support the full system BW (e.g. low-cost MTC)

Proposal: Phase 1 and later phases of NR should be designed with the following principles to ensure forward compatibility and compatibility of different features:

- Support of blank resources in time/frequency
- waveform with lower emissions outside the useful subbands compared to CP-OFDM without windowing and filtering
- Strive for
  - Minimizing the amount of signals/resources that needs to be transmitted irrespective of incoming traffic
  - Maximizing the amount of resources that can be flexibly utilized without causing backward compatibility issues in the future
  - Minimizing transmission of (always-on) wideband signals and channels
- Flexible configuration of signals, channels and resources
  - Strive to avoid short periodicity of always-on periodic signals and channels
  - Rely more on dynamically configured quantities
- Physical layer functionalities (signals, channels, signaling) should be confined within its flexibly-configured time/frequency resource (for control, data, reference signals)
- Rely more on UE-specific quantities

Decision: The document is noted.

Agreements:

- Phase 1 and later phases of NR should be designed with the following principles to ensure forward compatibility and compatibility of different features:
  - Strive for
    - Maximizing the amount of time and freq. resources that can be flexibly utilized or that can be left blanked without causing backward compatibility issues in the future
      - Blank resources can be used for future use
    - Minimizing transmission of always-on signals

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- Confining signals and channels for physical layer functionalities (signals, channels, signaling) within a configurable/allocable time/freq. resource

Possible observations
- For forward compatibility and for compatibility of different features within each release, the following observations are made:
  - Support of Coexistence over a single continuous block of spectrum
    - NR and other 3GPP RAT (e.g. LTE, NB-IoT)
    - different NR numerologies
    - different services using the same OFDM-based waveform with different numerology
  - Support of multiple services (in any phase/release)
    - services using future designs (e.g. waveform, frame structure, multiple access, etc)
  - Support of accommodating new technical features
    - seamlessly integrate new device categories
    - enable UEs that do not support the full system BW (e.g. low-cost MTC)

Not treated.

R1-162146	Consideration on forward compatibility	Huawei, HiSilicon
R1-162173	Discussion on forward compatibility for 5G new radio interface	Samsung
R1-162381	Forward compatibility for new radio interface	Intel Corporation
R1-162884	On the forward compatibility of the 5G New Radio	Nokia, Alcatel-Lucent Shanghai Bell
R1-163107	Forward compatibility for NR access technology	NTT DOCOMO, INC.
R1-163217	On forward compatibility	Ericsson
R1-162565	Consideration on numerologies in LTE/LTE-A and NR	Sony
R1-162566	Potential options of numerology setting for support of forward compatibility	Sony
R1-162868	Discussions on forward compatibility for new radio	CMCC
R1-163218	On positioning requirements for NR	Ericsson
R1-163219	On sidelink support in NR	Ericsson
R1-163220	Access-integrated backhaul	Ericsson
R1-163281	Considerations on forward compatibility for new radio interface	China Unicom

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

8.1.3 Evaluation assumptions for new radio interface

Discussions on models, scenarios, parameters, and methodology that can be used for evaluating technology proposals.

R1-163659 Evaluations assumptions for NR NTT DOCOMO
The document was presented by Takeda Kazuaki from NTT DOCOMO.
Discussion: Very first attempt (drawn by Tuesday's session) – aiming for review and try to agree some assumptions within the next couple of days (common consensus needed).
Chair: any companies can propose their views to the rapporteur.
Companies wondered whether the content can be very useful (if all can suggest whatever they like and nobody is forced performing evaluations and providing feedback)
Concern with the complexity of evalutions that assumptions may triggered
Decision: The document is noted. Continue offline discussion until Thursday – (NTT DOCOMO)

Tuesday conclusion:
Continue offline discussion about waveform and multiple access assumptions – Wuyong (Huawei), (also LGE, Qualcomm, ZTE, DOCOMO (KPI, metrics))
Continue offline discussion about channel coding and modulation related assumptions – Keeth (Nokia) (also LGE)
Continue offline discussion about antenna modeling assumptions (R1-163547) until Wednesday- (Intel)

Wednesday
R1-163557 Way forward on assumptions for multiple access evaluation Huawei, HiSilicon
Decision: The document is noted.
R1-163556 Way forward on assumptions for waveform evaluation Huawei, HiSilicon
Decision: The document is noted.

Possible agreements:

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- Link level simulation is used for waveform evaluation.
  - Whether and how to do system level simulation for waveform is FFS.
- Four evaluation cases should be used in link level simulation, which are
  - Case 1: DL single numerology case
  - Case 2: DL mixed numerology case
  - Case 3: UL single numerology case (asynchronous transmission)
  - Case 4: UL mixed numerology case (synchronous transmission)

  (refer to their illustrations from slides 6 – 8 in R1-163556)

R1-163713 Way Forward on requirements for the evaluation of channel coding scheme LG Electronics, Ericsson, CATT, AT&T, Fujitsu
Decision: The document is noted.

R1-163700 WF on Channel coding for 5G NR Nokia, Alcatel-Lucent Shanghai Bell
The document was presented by Keeth Jayasinghe from Nokia.
Decision: The document is noted. Further revised in **R1-163757**.
R1-163757 WF on Channel Coding Evaluation for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell, Samsung, Huawei, Sony, ZTE, Intel, Qualcomm, InterDigital, NTT DOCOMO
Discussion: Ericsson → preference to consider 256QAM modulation.
Decision: The document is noted, modified and agreed as follows:

Agreements: Coding Candidates
- Identified channel coding schemes for each usage scenario

eMBB	mMTC	URLLC
	Convolutional codes	Convolutional codes
LDPC	LDPC	LDPC
Polar	Polar	Polar
Turbo	Turbo	Turbo

- Common simulation assumptions are required to evaluate theoretical performance of proposed coding schemes
- Selection of the coding scheme should also consider various other aspects

Initial Simulation Assumptions
- Focus mainly on the BLER performance of candidate coding schemes.
- Evaluate performance of coding schemes with similar code rates and block sizes.
- Exact code constructions should be provided.
  - Example: Parity check matrices, polar code construction, ..
- Encoding/decoding complexity of the adopted algorithms should be described.

Agreements: Simulation assumptions : eMBB
- Evaluate the block error rate (BLER) performance versus SNR

Channel*	AWGN		
Modulation	QPSK, 64 QAM		
Coding Scheme	Turbo	LDPC	Polar
Code rate	1/5, 1/3, 2/5, 1/2, 2/3, 3/4, 5/6, 8/9		
Decoding algorithm**	Max-log-MAP	min-sum	List-X
Info. block length*** (bits w/o CRC)	100, 400, 1000, 2000, 4000, 6000, 8000 Optional(12K, 16K, 32K, 64K)		

* Fading channels will be simulated in the next stage
** These algorithms are starting points for further study. Other variants of agreed algorithms can be used for encoding and decoding (Complexity details should be illustrated)
*** At least these info. block length and code rate shall be evaluated. Other info. block lengths and code rates are not precluded. Similar info. and encoded block lengths should be used for the evaluation. Total coded bits = info. Block length/code rate. Note: these info. block length and code rate are only for initial performance evaluations. They are not interpreted as design targets or assumptions for complexity analysis.

- General guidelines
  - Existing code constructions can be used for evaluation

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- Whenever feasible, performance comparison should adopt coding constructions with matching computational complexities

Simulation assumptions : URLLC and mMTC

- Evaluate BLER performance versus SNR

Channel*	AWGN			
Modulation	QPSK, 16 QAM			
Coding Scheme	Convolutional codes	LDPC	Polar	Turbo
Code rate	1/12, 1/6, 1/3			
Decoding algorithm**	List-X Viterbi	min-sum	List-Y	Max-log-MAP
Info. block length*** (bits w/o CRC)	20, 40, 200, 600, 1000			
* Fading channels will be simulated in the next stage ** These algorithms are starting points for further study. Other variants of agreed algorithms can be used for encoding and decoding (Complexity details should be illustrated) *** At least these info. block length and code rate shall be evaluated. Other info. block lengths and code rates are not precluded. Similar info and encoded block lengths should be used for the evaluation. Total coded bits = info. Block length/code rate. Note: these info. block length and code rate are only for initial performance evaluations. They are not interpreted as design targets or assumptions for complexity analysis.				

- General guidelines
  - Existing code constructions can be used for evaluation
  - Whenever feasible, performance comparison should adopt coding constructions with matching computational complexities
  - BLER simulations down to 10^{-4} is recommended (to observe the error floor) for URLLC

R1-163547 **WF on antenna modelling and related parameters for NR evaluations** **Intel, Samsung**
Decision: The document is noted. Continue offline discussion about antenna modeling assumptions (revision in R1-163706) until Thursday- (Intel)

Thursday
R1-163706 **WF on antenna modelling for NR evaluations** **Intel, Samsung**
Discussion: Telecom Italia→ Concern that realistic antennas configurations be assumed for low bands (700 MHZ, 4GHZ) – repeated comment already formulated during the last plenary
Decision: The document is noted. Continue offline discussion about antenna modeling assumptions (revision in R1-163863) until Thursday- Alexei (Intel)

R1-163861 **Summary of evaluation assumptions for NR** **NTT DOCOMO**
The document was presented by Kazuaki Takeda from NTT DOCOMO.
Discussion: Telecom Italia→ same comment "realistic antennas configurations be assumed for 700 MHZ, 4GHZ" applies.
Fujitsu: various companies interested in evaluating the case of a carrier frequency around 4GHz for the micro layer in the dense urban scenario - should be captured.
Decision: The document is noted.

Agreements:
RAN1 agrees all proposals of R1-163861 including the following changes for carrier frequency for dense urban
Proposal: Macro layer: Around 4 GHz
Proposal: Micro layer: Around 30GHz, 4 GHz
Note that RAN1 will continue simulation assumptions
Note that antenna modeling and parameters will be updated

R1-163560 Way forward on assumptions for multiple access evaluation Huawei, HiSilicon
Decision: The document is noted.

Agreements:

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- Link-level simulation (LLS) and system-level simulation (SLS) are used for multiple access evaluation.
  - LLS* is used for feasibility investigation of new MA proposals, comparison of different proposals in typical scenarios
  - SLS is used for comparison of proposals, and verification with traffic/scheduling/multi-cell interference dynamics

* LLS includes LLS with optional analytical model.

Agreement: Slides 4, 5, 6, 7 in R1-163560 are agreed.

Conclusion:
- Preliminary LLS evaluation results are encouraged to be provided for RAN1#85

R1-163558 **Way forward on assumptions for waveform evaluation** **Huawei, HiSilicon**
The document was presented by Long Yi from Huawei.
Discussion: .
Decision: The document is noted.

Not treated.
R1-162382 General assumptions for evaluation of the new radio interface technology Intel Corporation
R1-162869 Evaluation method for new radio CMCC
R1-163221 Scenarios and Evaluation Methodology for NR Ericsson
R1-162148 Evaluation methodology discussion for 5G waveform Huawei, HiSilicon
R1-162196 URLLC KPI evaluation assumptions Qualcomm Inc.
R1-162174 Evaluation assumptions for 5G new radio interface: scenarios for SLS Samsung

R1-162147 General consideration on evaluation work for 5G new radio study Huawei, HiSilicon
R1-162149 Considerations on evaluation of new channel coding schemes Huawei, HiSilicon
R1-162154 Evaluation methodology for 5G non-orthogonal mulltiple access Huawei, HiSilicon
R1-162175 Evaluation assumptions for 5G new radio interface: details and KPIs for SLS Samsung
R1-162176 Evaluation assumptions for 5G new radio interface: LLS aspects Samsung
R1-162194 eMBB KPI evaluation assumptions Qualcomm Inc.
R1-162195 mMTC KPI evaluation assumptions Qualcomm Inc.
R1-162197 Other KPI evaluation assumptions Qualcomm Inc.
R1-162224 Evaluation assumptions for NR in RAN1 ZTE
R1-162303 Evaluation scenarios and configuration parameters for new radio interface CATT
R1-162304 Evaluation methodology and models for evaluating technology proposals CATT
R1-162383 Discussion on antenna modelling for the new radio interface technology evaluations Intel Corporation
R1-162427 Discussion on evaluation issues for new RAT NEC Corporation
R1-162515 Discussion on the evaluation assumptions for NR LG Electronics
R1-162792 Discussion on evaluation assumptions for new radio interface MediaTek Inc.
R1-162885 On the phase noise model for 5G New Radio evaluation Nokia, Alcatel-Lucent Shanghai Bell
R1-162886 On the power amplifier model for the 5G New Radio evaluation Nokia, Alcatel-Lucent Shanghai Bell
R1-162887 On the network energy efficiency requirement and evaluation for the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-162888 On the link and system evaluation assumptions for the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-162948 Considerations on numerology evaluation Huawei, HiSilicon
R1-163108 Deployment scenarios and evaluation methodology for NR NTT DOCOMO, INC.
R1-163109 Evaluation methodologies for waveform study NTT DOCOMO, INC.
The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

8.1.4 Waveform and multiple access schemes for new radio interface

R1-162150 Room for possible improvement of LTE spectral efficiency in new radio of 5G Huawei, HiSilicon
R1-163125 Considerations on multiple access sheme for new radio interface CATR
R1-163310 Need for study on In-Band Full Duplex communication CEWiT

8.1.4.1 Waveform

R1-162248 **Waveform for the Next Generation Radio Interface** **Idaho National Laboratory**

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The document was presented by Ramon Khalona from INL and .

- Observation: To overcome all of the above inefficiencies of OFDM and to meet the new requirements a new waveform should be considered.
- Observation: FBMC systems provide much better spectral shaping and relaxed output filter requirements than OFDM.
- Proposal: Filtered OFDM/UFMC should be considered as one of the waveform candidates; however, a proper analysis must be performed to understand the trade-offs against the conventional OFDM.
- Proposal: FBMC should be considered as one of the waveform candidates, including a detailed analysis of its benefits vs. complexity trade-offs.

Decision: The document is noted.

R1-163311 Discussion on new waveforms CEWiT

The document was presented by … from CEWiT and proposes to consider and study both OFDM and non-OFDM based waveforms as candidate waveforms for the NR systems.

Decision: The document is noted.

R1-162152 OFDM based flexible waveform for 5G Huawei, HiSilicon

The document was presented by … from Huawei and .

Observation: OFDM-based orthogonal waveforms have the following advantages:

- Supporting a flexible and forward compatible air interface;
- Enhanced spectrum localization performance;
- Reuse of legacy OFDM-based transmission thanks to the complex-domain orthogonality retained within sub-bands;
- Amicable to MIMO technologies;
- Simpler insertion of reference signals.

Proposal: OFDM based orthogonal waveforms including filtered-OFDM, windowing-OFDM, UF-OFDM should be considered for further evaluation.

Decision: The document is noted.

R1-163110 Initial link level evaluation of waveforms NTT DOCOMO, INC.

The document was presented by Petra Weitkemper from NTT DOCOMO.

- Observation 1: W-OFDM, F-OFDM and FBMC/OQAM could much improve the OOB emission compared to traditional CP-OFDM.
- Observation 2: F-OFDM could reach overall better OOB performances compared to W-OFDM.
- Observation 3: W-OFDM and F-OFDM are more suited for short burst transmission compared to FBMC/OQAM.
- Observation 4: Without DFT spread, all the waveforms have similar PAPR performance.
- Observation 5: Introducing DFT spread to F-OFDM and W-OFDM has similar PAPR impact compared to CP-OFDM.
- Observation 6: Introducing DFT spread to FBMC/OQAM lead to much lower PAPR reduction compared to the other waveforms.
- Observation 7: The BLER performances of W-OFDM, UF-OFDM and FBMC/OQAM is close to traditional CP-OFDM, while f-OFDM suffers loss for high coding rates.
- Observation 8: Introducing tone offset subcarriers improves the f-OFDM BLER performance with high coding rates. The loss compared to other waveforms becomes minor.
- Observation 9: Under extreme high mobility, FBMC/OQAM outperforms other waveforms.
- Observation 10: All considered waveforms perform similar with 2x2 MIMO spatial multiplexing and linear receivers. Observations 7, 8 and 9 are also valid here.
- Observation 11: Non-linear MIMO schemes like Alamouti or sphere detection cannot be easily combined with OQAM modulation. This is drawback for FBMC/OQAM.
- Observation 12: W-OFDM, UF-OFDM, f-OFDM and FBMC/OQAM outperform CP-OFDM under asynchronous access transmission due to their reduced OOB emissions.
- Observation 13: FBMC/OQAM and f-OFDM needs much smaller of guard subcarriers to achieve the same performance as the synchronous CP-OFDM compared UF-OFDM and W-OFDM.
- Observation 14: Introducing tone offset subcarriers degrades the f-OFDM BLER performance under asynchronous access transmission. The wider filter bandwidth increases the interference to the neighboring users.
- Proposal 1: CP-OFDM should be considered as the baseline waveform.
- Proposal 2: W-OFDM and F-OFDM should be further considered as new waveform candidates.

Decision: The document is noted.

R1-162750 Link-level performance evaluation on waveforms for new RAT Spreadtrum Communications

The document was presented by Jinhui Chen from Spreadtrum.

- Observation 1: When uplink transmission are synchronized in time but not in frequency, F-OFDM achieves small gain over OFDM against CFO, while FBMC achieves significant gain over OFDM against CFO except for the closest subcarrier that suffers from loss of real-orthogonality.

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- Observation 2: When uplink transmission are synchronized in frequency but not in time, F-OFDM achieves moderate gain over OFDM against time offset while FBMC achieves significant gain over OFDM except for the closest subcarrier that suffers from loss of real-orthogonality.
- Observation 3: For OFDM, interference from the numerology with large subcarrier spacing to that with small subcarrier spacing is higher than the other way around.
- Observation 4: When numerologies with different subcarrier spacing coexist, F-OFDM achieves marginal gain over OFDM, while FBMC achieves significant gain at a cost of one subcarrier as the guard band.

Decision: The document is noted.

R1-162925 Design considerations on Waveform in UL for New Radio systems INTERDIGITAL COMMUNICATIONS

The document was presented by … from InterDigital.

- Proposal: Waveforms which use DFT-S-OFDM as a basis should be studied for the UL of the new radio.

Discussion: .
Decision: The document is noted.

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

Not treated.

R1-162930	OTFS Waveform for New RAT	Cohere Technologies
R1-163327	Waveform for New Radio	Motorola Mobility Germany GmbH
R1-162151	Considerations on 5G Waveform	Huawei, HiSilicon
R1-162177	Waveform and multiple access for 5G new radio interface	Samsung
R1-162198	Waveform requirements	Qualcomm Inc.
R1-162199	Waveform candidates	Qualcomm Inc.
R1-162200	Waveform evaluation proposals	Qualcomm Inc.
R1-162225	Discussion on new waveform for new radio interface	ZTE
R1-162333	On new waveforms for New RAT	Fujitsu
R1-162384	Considerations on waveform selection for new radio interface	Intel Corporation
R1-162516	Flexible CP-OFDM with varible ZP	LG Electronics
R1-162537	Views on NR waveforms	Mitsubishi Electric
R1-162548	Considerations on Waveform Design for New RAT	Spreadtrum Communications
R1-162551	Considerations on waveform design for new radio interface	Panasonic Corporation
R1-162793	Waveform Candidates for Next Generation New Radio Access	MediaTek Inc.
R1-162889	OFDM based Waveform for 5G new radio interface	Nokia, Alcatel-Lucent Shanghai Bell
R1-162890	5G Waveforms for the Multi-Service Air Interface below 6 GHz	Nokia, Alcatel-Lucent Shanghai Bell
R1-163222	Waveform for NR	Ericsson
R1-163223	Using OFDM in NR	Ericsson
R1-163224	Feasibility of Mixing Numerology in an OFDM System	Ericsson

8.1.4.2 Multiple access scheme

R1-163160 Generalized Precoded OFDMA (GPO) IITH

The document was presented by Kiran Kuchi from IITH.
Decision: The document is noted.

R1-162153 Overview of non-orthogonal mutliple access for 5G Huawei, HiSilicon

The document was presented by … from Huawei.

- Observation 1: The expected functionalities for 5G MA are different in each usage scenario and are summarized (see Table 1).
- Observation 2: Non-orthogonal MA can have advantage over OMA in many aspects (see Table 2), which deserves careful investigation in 5G NR.
- Proposal 1: Code domain non-orthogonal design is needed in addition to the power domain superposition to deal with channel and interference uncertainties.
- Proposal 2: Sparse spreading is an important feature in the code domain design to enable high level of overloading with close to ML detection performance and reasonable detection complexity.

Decision: The document is noted.

R1-162155 Sparse Code Multiple Access (SCMA) for 5G Radio Transmission Huawei, HiSilicon

- Multi-dimensional modulation and sparse spreading should be further studied as a candidate scheme for non-orthogonal multiple access for 5G new radio.

Decision: The document is noted.

R1-162870 On Unified Framework for Multi-Access Schemes CMCC

The document was presented by Nan Hu from CMCC.

- Proposal 1: Considering diversified 5G scenarios and enhanced performance requirements, new multiple access schemes should be studied.
- Proposal 2: It is preferred to compare the structure of various non-orthogonal multiple access schemes for a better understanding of their mechanisms which may facilitate future down selection and harmonization in RAN1. A unified framework of multiple access techniques is proposed for such comparison.
- Proposal 3: Current proposed non-orthogonal multiple-access schemes may be merged to a single non-orthogonal multiple-access scheme based on the unified framework, while the orthogonal multiple-access scheme should be a special of the merged non-orthogonal multiple-access scheme.

Decision: The document is noted.

R1-162203 NR multiple access evaluation proposals Qualcomm Inc.

The document was presented by … from Qualcomm.

- Proposal 1: different multi-access candidates can be evaluated/optimized for different use cases, such as eMBB, eMTC and uRLLC. However, it is recommended to start with analytic comparisons before directly going to full blown system level simulations. This can include, but not limited to:
  - Capacity analysis for NOMA vs OMA for eMBB
  - Link budget vs capacity trade-off for mMTC
  - Signaling overhead for NOMA vs OMA for mMTC
- Proposal 2: If there is a clear need to do system level simulations for evaluation/decision, agreement has to be made regarding the evaluation assumptions, then different scheme can be compared focusing on the key performance matric list (see section 3).

Decision: The document is noted.

R1-163383 Candidate Solution for New Multiple Access CATT (R1-162306)

The document was presented by … from CATR and deals with a code based NOMA scheme with following characters to alleviate error propagation problem of SIC:

- It takes joint optimization of transmitter and receiver, with unequal transmission diversity order but identical diversity order after detection.
- It uses sparse coding to map user data onto sharing resources.

System level evaluation results show that the proposed NOMA scheme is beneficial in both spectrum efficiency and connection density.

Decision: The document is noted.

R1-162517 Considerations on DL/UL multiple access for NR LG Electronics

The document was presented by … from LGE.

- Suggestion 1: OMA (e.g. OFDMA for DL, SC-OFDMA for UL) should be considered as a baseline MA scheme for NR study.
- Suggestion 2: OFDMA can also be considered as MA scheme for UL in NR if PAPR of the UE operating in NR system is not important issue.
- Suggestion 3: To consider NoMA schemes as a candidate of the MA schemes in NR, it is required to justify the advantages and/or to complement the defects.
- Suggestion 4: It can be considered to use NoMA scheme such as NCMA in order for supporting massive connectivity or contention based MA in special scenarios.
- Suggestion 5: Combination of multiple MA schemes, including OMA and NoMA schemes can be considered for NR design in special scenarios.

Decision: The document is noted.

R1-163695 WF on multiple access for NR ZTE, Qualcomm Incorporated

- Non-orthogonal multiple access should be evaluated for all three scenarios: mMTC, eMBB, ULLRC.
- For uplink transmission for mMTC,
  - Non-orthogonal transmission is grant-free based
  - The candidate non-orthogonal schemes include (but not limited to):
    - Multi-user shared access (MUSA)
    - Resource spread multiple access (RSMA)
    - Sparse code multiple access (SCMA)
    - Pattern defined multiple access (PDMA)
    - Non-orthogonal coded multiple access (NCMA)
    - Frequency domain spreading

Decision: The document is noted.

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Observations:
- Examples non-orthogonal schemes include (but not limited to):
  - For UL, Multi-user shared access (MUSA) (e.g., R1-162226)
  - Resource spread multiple access (RSMA) (e.g., R1-163510)
  - Sparse code multiple access (SCMA) (e.g., R1-162153)
  - Pattern defined multiple access (PDMA) (e.g., R1-163383)
  - Non-orthogonal coded multiple access (NCMA) (e.g., R1-162517)
  - Low code rate spreading (e.g., R1-162385)
  - Frequency domain spreading (e.g., R1-162385)
  - Non-orthogonal multiple access (NOMA) (e.g., R1-163111)

R1-163656 WF on multiple access for NR CMCC, Huawei, HiSilicon, Fujitsu, CATT, China Telecom

Observation: Non-orthogonal multiple access methods proposed for the ~~5G~~ NR within this meeting show potentials to have benefits over orthogonal MA for eMBB, mMTC and URLLC respectively
- Non-orthogonal MA (No-MA) should be investigated for diversified ~~5G~~ NR usage scenarios and use cases, including at least eMBB (UL and DL), mMTC (UL), and URLLC (UL)
- Code and/or power domain No-MA schemes should be studied
- At least for UL mMTC, autonomous/grant-free/contention based No-MA should be studied
- Flexible MA framework should be studied which can select and/or adjust between OMA and No-MA

Discussion: Better not use 5G in 3GPP.
Decision: The document is noted.

Agreements:
- Non-orthogonal multiple access should be investigated for diversified NR usage scenarios and use cases
- At least for UL mMTC, autonomous/grant-free/contention based non-orthogonal multiple access should be studied

The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

R1-162178	Multiple access for different vertical services in 5G new radio interface Samsung
R1-162201	NR multiple access requirements Qualcomm Inc.
R1-162202	Candidate NR multiple access schemes Qualcomm Inc.
R1-162226	Discussion on multiple access for new radio interface ZTE
R1-162305	Multiple Access for 5G New Radio InterfaceCATT
R1-162334	On non-orthogonal multiple access technologies Fujitsu
R1-162385	Multiple access schemes for new radio interface Intel Corporation
R1-162552	Considerations on multiple access schemes for new radio interface Panasonic Corporation
R1-162568	Multiplexing and multiple access for mmWave networks ETRI
R1-162794	Contention-based uplink access MediaTek Inc.
R1-162891	Scheduling framework and related requirements Nokia, Alcatel-Lucent Shanghai Bell
R1-162892	Uplink contention-based access in 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-162922	Discussion on Multiple Access for New Radio systems INTERDIGITAL COMMUNICATIONS
R1-163111	Initial views and evaluation results on non-orthogonal multiple access for mMTC uplink NTT DOCOMO, INC.

8.1.5 Numerology and frame structure for new radio interface

R1-163536 Numerology and frame structure for 5G new radio interface: over-6GHz Samsung (R1-162180)

The document was presented by … from Samsung.
- Proposal 1: The numerology design of over-6 GHz (e.g., around 30 GHz and 70 GHz) and sub-6 GHz (e.g., around 4 GHz) needs to be separately optimized.
- Proposal 2: For the numerology design over 6 GHz, study of bands below 40 GHz is prioritized over that of bands above 40 GHz.
- Proposal 3: The numerology above 6 GHz should be designed to support at least the coverage of ISD = 200m.
- Proposal 4: CP length should be long enough to compensate the channel delays and other effects while keeping a reasonable CP overhead ratio (e.g., longer than 300 – 400 ns).
- Proposal 5: Based on observations 8, 11 and 12, it is preferred to use 75 kHz as subcarrier spacing for 5G new radio interface over 6 GHz, especially for the carrier frequency range between 28 GHz and 40 GHz.
- Proposal 6: It is preferred to use 150 kHz as subcarrier spacing for 5G new radio interface over 40 GHz if subcarrier spacing larger than 75 kHz is needed.

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- Proposal 7: Taking into account implementation complexity, maximum FFT size should be limited and we prefer to use 2048 FFT size and 100 MHz bandwidth per CC for 75 kHz subcarrier spacing as a baseline.
- Proposal 8: For 5G new air interface over 6 GHz, TDD is preferred rather than FDD and Self-contained frame structure is supported for forward compatibility.

Decision: The document is noted.

R1-162206 Frame structure requirements Qualcomm Inc.

The document was presented by … from Qualcomm.

- Proposal 1: Frame structure should be composed of two fundamental units, i.e., TTIs and SFs. A *Transmission Time Interval (TTI)* is the smallest time unit over which transmission can occur, in multiples of symbols. A *Subframe (SF)* is the smallest unit consisting of one or multiple TTIs, such that both a transaction from the source to destination and a transaction from the destination to the source are completed. There may be one or multiple TTIs per SF.
- Proposal 2: Frame structure should allow for scalability to address different services. This should include supporting of services with a target HARQ-RTT latency of 1ms, or services with an end-to-end application layer latency of 1ms.
- Proposal 3: Frame structure should allow for multiplexing of different services, such as EMBB and URLLC.
- Proposal 4: Frame structure should accommodate user multiplexing according to the topologies of basestation-to-UE uplink and downlink, and UE-to-UE sidelink.
- Proposal 5: Frame structure should support very wideband as well as narrowband deployment scenarios, including TDD and FDD allocations, and address both sub-6GHz and mmW spectrum.
- Proposal 6: Frame structure should be able to exploit channel reciprocity efficiently in TDD through availability of frequent sounding opportunities.
- Proposal 7: Frame structure should enable dynamic TDD assignment with support for managing interference between source and destination pairs (e.g., among uplink, downlink, or sidelink).
- Proposal 8: Frame structure should enable *self-contained subframes*, whereby the source-to-destination transmission as well as the response to that transmission, going from the destination-to-source, are both contained in the same subframe.
- Proposal 9: Frame structure should enable self-contained subframes with a single interlace structure.
- Proposal 10: Frame structure may include multiple interlaces subject to forward compatibility constraints.
- Proposal 11: Frame structure may include multiple interlaces subject to overhead constraints for given target latency.
- Proposal 12: Frame structure should allow for modes where a short intermediate round of communication between the source and destination can occur within a subframe.
- Proposal 13: Frame structure should allow for tight coupling across aggregated carriers.

Decision: The document is noted.

R1-163397 Numerology requirements Qualcomm Inc. (R1-162204)

The document was presented by Tingfang Ji from Qualcomm.

- Proposal 1: Numerology design should be determined based on the general requirements in Section 2 for the specific deployment scenario.
- Proposal 2: It is proposed to have scaled subcarrier spacing = $\Delta f_0 * 2^k$ in order to achieve high multiplexing efficiency between different numerologies.
- Proposal 3: It is proposed to have 2^M symbols per TTI to ensure flexible TTI downscaling for URLLC from 2^M symbols to 1.
- Proposal 4: It is proposed to have 2^M symbols per TTI and scaled subcarrier scaling = $\Delta f_0 * 2^k$ at the same time to ensure flexible numerology scaling up and down in the same TTI. Scalable short symbols are to support low latency and scalable long symbols are to ensure robustness in MBSFN/COMP type of features.
- Proposal 5: it is proposed to have NR numerology family as:
  - subcarrier spacing $\Delta f_k = \Delta f_0 * 2^k$,
  - $CP_k = CP_0/2^k$,
  - $16*2^k$ symbols per ms,

  where one example is: Δf_0 = 17.5 kHz, CP_0 = 5.36us, 16 symbols per ms and k is an integer.

Decision: The document is noted.

R1-162386 Numerology for new radio interface Intel Corporation

The document was presented by Joonyoung Cho from Intel.

- Proposal 1: For operating frequencies in low-to-mid frequency bands (for e.g., > 6 GHz and < 40 GHz), 75 kHz subcarrier spacing is preferred because of frequency drift and phase noise considerations.
- Proposal 2: For high frequency bands (e.g., >=40 GHz), a much higher subcarrier spacing (e.g., 375 kHz) can be considered.
- Proposal 3: The radio frame length is recommended to be kept as 10 ms, regardless of subcarrier spacing for efficient inter operations between LTE and NR-Phase 1 and NR-Phase 2.
- Proposal 4: For high frequency bands (e.g., >=40 GHz), designing a system targeting delay spread of omnidirectional channel can result in high overheads, thus re-configurable CP lengths can be considered as an option to reduce overheads and improve spectral efficiency.

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- Proposal 5: A TTI of 0.2 ms consisting of 14 symbols when 75 kHz subcarrier spacing is used should be considered for NR for low-to-mid frequency bands (for e.g., > 6 GHz and < 40 GHz).

Decision: The document is noted.

R1-162742 **Frame structure design for next radio interface** **Lenovo (Beijing) Ltd**

The document was presented by Xinghua Song from Lenovo.

- Proposal 1: Multiple TTI lengths with scalability should be supported in NR.
- Proposal 2: For NR, the following subframe types are supported
  - Special subframe containing DL(data and/or control), GP, and UL (data and/or control)
  - DL only subframe
  - UL only subframe
- Proposal 3: Dynamic TDD should be supported and how to signal the flexible TDD frame structure should be studied.

Discussion: Fujitsu→ what subframe duration being considered. Lenovo→ may depend on the scenarios to be supported

Decision: The document is noted.

R1-162795 **Numerology Considerations for Next Generation New Radio Access** **MediaTek Inc.**

The document was presented by Pekai Liao from MediaTek.

- Proposal 1: A set of OFDM-based numerologies supporting all the deployment scenarios should be studied, including one that is backward compatible with LTE and one tailored to dense urban with sub-carrier spacing of 60 or 75 kHz.
- Proposal 2: The design should consider the system aspects such as cyclic-prefix overhead, resource block granularity as well as the device implementation aspects such as FFT size, clock rate, etc.

Decision: The document is noted.

R1-163112 **Initial views on frame structure for NR access technology** **NTT DOCOMO, INC.**

The document was presented by Fred Takeda from NTT DOCOMO.

- Observation 1: Lean radio-frame with flexible dynamic TDD would be a good candidate radio frame design for the new RAT.
- Observation 2:
  - Fixed DL subframe is transmitted by TP periodically to deliver necessary channels/signals/RSs.
    - Necessary functions and their periodicities could be different depending on use-case and scenario.
  - Further investigation is necessary on how to design the fixed DL subframe.
    - Forward compatibility should be taken into account.
- Observation 3: Further study is necessary on how to design dynamic subframe.
  - It is highly important to ensure high flexibility in dynamic subframe operations.
    - It is desirable to indicate the usage of each subframe by the DL control signalling in the subframe.
    - It is desirable to support flexible (explicit) operations of HARQ and CSI feedback.
  - Self-contained operation would bring different benefits and can also be another solution.
    - Very quick HARQ-ACK feedback can realize extra low latency operation.
    - Overhead saving by linking time/frequency resource information between the channels/signals.

Decision: The document is noted.

R1-163227 **Numerology for NR** **Ericsson**

The document was presented by Erik Dahlman from Ericsson and proposes to adopt 3 different OFDM numerologies for 5G new RAT; 15, 30, and 60 kHz. All numerologies are derived from the baseline 15 kHz numerology via scaling. The 15 kHz numerology is identical to LTE.

- Proposal 1: 5G new RAT will define a set of OFDM numerologies
- Proposal 2: Other OFDM numerologies of the set are derived from the baseline OFDM numerology of the set via scaling
- Proposal 3: A subcarrier spacing is integer dividable by all smaller subcarrier spacings of the set
- Proposal 4: The baseline OFDM numerology for 5G new RAT is the LTE numerology including both normal and extended cyclic prefix ($\Delta f_1, T_{ofdm,1}, T_{cp,1}, T_{cp,1}{}'$)
- Proposal 5: For 5G new RAT Phase I, in addition to the baseline OFDM numerology the following OFDM numerologies are defined: ($\Delta f_2 = 2 \cdot 15$ kHz $= 30$ kHz, $T_{ofdm,2} = 66.67/2$ µs $= 33.33$ µs, $T_{cp,2} = 4.69/2$ µs $= 2.35$ µs, $T_{cp,2}{}' = 16.67/2$ µs $= 8.33$ µs) and ($\Delta f_3 = 4 \cdot 15$ kHz $= 60$ kHz, $T_{ofdm,3} = 66.67/4$ µs $= 16.67$ µs, $T_{cp,3} = 4.69/4$ µs $= 1.17$ µs, $T_{cp,3}{}' = 16.67/4$ µs $= 4.17$ µs).

Discussion: Compatibility with IoT is key aspect when refarming LTE to 5G new RAT.

Decision: The document is noted.

R1-163605 **WF on NR Numerology** **NTT DOCOMO, INC.**

The document was presented by Fred Takeda from NTT DOCOMO.

- For NR, it is necessary to support more than one values of subcarrier-spacing
  - A value of subcarrier-spacing is derived from a particular value of subcarrier-spacing multiplied by N where N is an integer

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- Alt.1: At least one of LTE subcarrier-spacing (15 kHz) is one of the supported values
  - FFS: Whether other LTE subcarrier-spacing are also the supported values
- Alt.2: Any LTE subcarrier-spacing is not one of the supported values
- FFS: exact value of the particular value and possible values of N

– The values of possible subcarrier-spacing will be further narrowed-down in RAN1#85

Decision: The document is noted.

Possible agreements
For NR, it is necessary to support more than one values of subcarrier-spacing

- Values of subcarrier-spacing are derived from a particular value of subcarrier-spacing multiplied by N where N is an integer
  - Alt.1: Subcarrier-spacing values include 15 kHz subcarrier spacing (i.e LTE based numeroly)
  - Alt.2: Subcarrier-spacing values are based on multiple or division of 15 kHz subcarrier spacing without 15 kHz subcarrier spacing (LGE's proposal)
  - Alt.3: Subcarrier-spacing values include 17,5 kHz subcarrier spacing with uniform symbol duration including CP length
    - Note: other values are not precluded
  - FFS: exact value of the particular value and possible values of N
- The values of possible subcarrier-spacing will be further narrowed-down in RAN1#85

Agreements

- For NR, it is necessary to support more than one values of subcarrier-spacing
  - Values of subcarrier-spacing are derived from a particular value of subcarrier-spacing multiplied by N where N is an integer
    - Alt.1: Subcarrier-spacing values include 15 kHz subcarrier-spacing (i.e., LTE based numerology)
    - Alt.2 Subcarrier-spacing values include 17.5 kHz subcarrier-spacing with uniform symbol duration including CP length
      - Note: Other values are not excluded
    - Note: other alternatives are not precluded
    - FFS: exact value of a particular value and possible values of N
  - The values of possible subcarrier-spacing will be further narrowed-down in RAN1#85
- Companies are encouraged to provide detailed analysis and input the views in the following table

	Proponent name			
	Set 1	Set 2	Set 3	…Set X
Subcarrier-spacing (kHz)				
Component carrier bandwidth (MHz)				
OFDM symbol length (μs)				
CP length (μs)				
Nb of symbols / subframe				
Subframe length (ms)				
Frame length (ms)				
Note				

R1-162931 **Frame Structure and Numerology for New RAT Cohere Technologies**

- Proposal: Consider a configurable frame and numerology to address the diverse next generation deployment scenarios
  - In particular, consider a configurable TTI length to meet the performance targets for all use cases

Decision: The document is noted.

R1-162227 **Numerology design of new RAT ZTE**
Decision: The document is noted.

Wednesday
R1-163620 **15 KHz and 17.5 KHz based numerology comparison** **Qualcomm Incorporated**
The document was presented by Tingfang Ji from Qualcomm.
Decision: The document is noted.

R1-163715 **WF on Numerology Comparison Qualcomm Incorporated, ZTE**
The document was presented by Jing Jiang from Qualcomm.
Scalable numerology: 15kHz vs. 2^N family comparison

- Link-level numerology comparison (simulation)
  - Typical 3GPP channel models: scaled EPA/EVA/ETU depending on deployment scenarios
  - Numerology evaluation over mmWave band
- TTI scaling down (analysis)

- Comparison between 15kHz (non-integer symbol) vs. 17.5kHz (scalable number of symbols)
- Link-level evaluation of long CP (simulation)
  - Long DS channel model performance evaluation at the link-level
  - 15kHz family based on LTE ECP vs. 17.5kHz scaled SCS (8.75kHz or 4.375kHz)
- NB-IOT coexistence evaluation (simulation/analysis)
  - Guardband overhead comparison
- LTE TDD Coexistence (analysis):
  - Additional GP overhead quantification
- Sampling Rate Complexity (analysis)

Decision: The document is noted. Continue offline.

R1-163559 **WF on Band Agnostic Numerology Specification Huawei, HiSilicon, Ericsson**

The document was presented by David Mazzarese from Huawei.

- RAN1 specifications and PHY features of the New Radio should continue to be specified in a band-agnostic manner
  - OFDM numerologies supported by NR will not be limited to any specific band or frequency range in RAN1 specifications
  - In particular, the higher-order numerologies should not only be limited to higher frequencies
  - strive for a common structure regardless of frequency-band of operation considering different channel characteristics and target verticals

Discussion: Huawei suggested having at least that the band agnostic aspect be a common understanding.
Samsung too early to agree such statement → want to let RAN4 decide
Decision: The document is noted.

Thursday

R1-163770 **WF on Scaling of subcarrier spacing Ericsson, Qualcomm, Nokia, Alcatel Lucent Shanghai Bell, NTT DOCOMO**

The document was presented by Stefan Parkvall from Ericsson.

- The subcarrier spacing for the NR scalable numerology should scale as
  - $f_{sc} = f_0 * 2^m$ where
    - f_0 is FFS
    - m is an integer chosen from a set of possible values

Decision: The document is noted.

Possible agreement

- The subcarrier spacing for the NR scalable numerology should scale as
  - $f_{sc} = f_0 * m$ where
    - f_0 is FFS
    - m is an integer chosen from a set of possible positive values

Possible agreement

- The subcarrier spacing for the NR scalable numerology should scale as
  - $f_{sc} = f_0 * m^n$ where
    - f_0 is FFS
    - m is one value and is an integer chosen from a set of possible positive values
    - n is an integer chosen from a set of possible values

Possible agreements:

- For future evaluations, RAN1 assumes
  - The subcarrier spacing for the NR scalable numerology should scale as
  - $f_{sc} = f_0 * 2^m$ where
    - f_0 is FFS
    - m is an integer chosen from a set of possible values
- Other values are not precluded
  - Possible other values include followings
    - The subcarrier spacing for the NR scalable numerology should scale as
    - fsc = f0 * m where
      - f0 is FFS
      - m is an integer chosen from a set of possible positive values
- RAN1 continues further study until #85 meeting

Agreements:

- RAN1 will continue further study and conclude between following alternatives in the next meeting
  - Alt. 1:

        - The subcarrier spacing for the NR scalable numerology should scale as
        - $f_{sc} = f_0 * 2^m$ where
            - f_0 is FFS
            - m is an integer chosen from a set of possible values
    - Alt. 2:
        - The subcarrier spacing for the NR scalable numerology should scale as
        - $f_{sc} = f_0 * M$ where
            - f_0 is FFS
            - M is an integer chosen from a set of possible positive values
- All companies are requested to analyze/evaluate following aspects
    - Realistic phase noise
    - How each alternative allows mixing different numerologies
- All companies are requested to propose exact values of
    - f_0, m, and M

R1-163554 **WF on Band Agnostic Numerology Specification Huawei, HiSilicon**
The document was presented by David Mazzarese from Huawei.
- For the study of NR, RAN1 assumes that OFDM numerologies with different subcarrier spacings are allowed to be used in the same band and frequency range
    - For example 15 kHz subcarrier spacing and 60 kHz subcarrier spacing could both be used below 6 GHz

Decision: The document is noted and is modified as follows:

Agreements:
- For the study of NR, RAN1 assumes that multiple (but not necessarily all) OFDM numerologies can apply to the same frequency range
    - Note: RAN1 does not assume to apply very low value of subcarrier spacing to very high carrier frequency

Not treated.
R1-162156 Scenario & design criteria on flexible numerologies Huawei, HiSilicon
R1-162157 Overview of 5G frame structure Huawei, HiSilicon
R1-162158 Support for wide bandwidth for 5G Huawei, HiSilicon
R1-162159 Deployment of 5G spectrum below 6 GHz Huawei, HiSilicon
R1-162179 Numerology and frame structure for 5G new radio interface: sub-6GHz Samsung
R1-162205 Numerology evaluation criteria Qualcomm Inc.
R1-162207 Candidate frame structuresQualcomm Inc.
R1-162228 Frame structure design of new RAT ZTE
R1-162307 Numerology for the 5G new radio interface CATT
R1-162308 Frame structure design for 5G new radio interface CATT
R1-162335 On new frame structure for New RAT Fujitsu
R1-162338 Numerology and Frame Structure Design Considerations for NR Guangdong OPPO Mobile Telecom.
R1-162428 Discussion on numerology and frame structure for NR NEC Corporation
R1-162518 Discussion on numerology design for New RAT LG Electronics
R1-162519 Discussion on frame structure for NR LG Electronics
R1-162549 Discussion on numerology and frame structure Spreadtrum Communications
R1-162550 Initial considerations on the framework for 5G new RAT Spreadtrum Communications
R1-162569 Scalable TTI for new radio frame structure ETRI
R1-162579 Numerology and frame structure for New Radio INTERDIGITAL COMMUNICATIONS
R1-162726 Frame structure for new radio interface Intel Corporation
R1-162796 Views on frame structure for new radio access technology MediaTek Inc.
R1-162871 Discussion on the numerology and frame structure design for new radio CMCC
R1-162893 Basic frame structure principles for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-162894 Flexible numerology for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-162895 Support for Beam Based Common Control Plane in 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-163113 Initial views on numerology for NR access technology NTT DOCOMO, INC.
R1-163118 Considerations on 5G new RAT numerologyBeijing Xinwei Telecom Techn.
R1-163132 Discussions on the frame structure design for NR CATR
R1-163225 Duplex scheme for NR Ericsson
R1-163226 Frame structure for NR Ericsson
R1-163228 Flexible bandwidth in NR Ericsson
R1-163229 Hybrid-ARQ acknowledgements for NR Ericsson
R1-163230 Latency in NR Ericsson

R1-163295 Scalable numerology for New RAT Sharp
R1-163328 Numerology for New Radio Motorola Mobility Germany GmbH
R1-163330 Discussion on numerology for 5G New RAT KT Corp.
R1-163331 Considerations on frame structure for New RAT KT Corp.
The document was presented by … from … and .
Discussion: .
Decision: The document is noted.

Friday
R1-163903 Way Forward on Frame Structure for NR Qualcomm Incorporated, NTT DOCOMO, Panasonic
- At least the following should be considered in the NR frame structure study:
  - A time interval with demodulation RS, the assignment, the acknowledgement, and data
  - The RS used for the demodulation of the data is only within this time interval
  - The design should not preclude the possibility for the following
    - The assignment for the data in this time interval and corresponding RS used for the demodulation are only within this time interval.
    - The acknowledgment for the data in this time interval and corresponding RS used for the demodulation are only within this time interval.

Discussion: LG→ different proposal in R1-163886
Huawei→ Time interval characteristics far to be clear- too early to agree.
Ericsson→ good starting point
Decision: The document is noted.
R1-163886 WF on frame structure for NR LG Electronics, Qualcomm Incorporated, Lenovo
- At least followings are considered in design of frame structure for NR
  - Three types of schedulable time unit can be defined, each consisting of:
    - 1) DL transmission only, 2) UL transmission only, 3) both DL and UL transmissions
    - DL transmission can include DL control and/or DL data
    - UL transmission can include UL control and/or UL data
    - Further study is necessary on:
      - Combination of control/data part within each type of time unit
      - Location of control/data resource within each type of time unit

Decision: The document is noted. No consensus for neither of the proposals.
Ericsson → would be worth trying to list a number of topics to look at (considered as key aspects for further progress)
RAN1 chair: can set up an email discussion to address the frame structure proposals
Samsung → do not understand why the proposals should be discussed
NTT DOCOMO: email discussion may help to capitalize on the offline discussions made during the week and further get rid of the confusions
Focus could be on understanding time interval regarding demodulation RS, assignment, acknowledgement and data.
Conclusion:
Email discussion

8.1.6 Channel coding and modulation for new radio interface

8.1.6.1 Channel coding

R1-162181 Channel coding for 5G new radio interface Samsung
The document was presented by … from Samsung.
- Proposal 1: Companies are encouraged to provide qualitative and/or quantitative info on hardware complexity in order to support 20Gbps decoding throughput (for both new channel coding scheme and LTE turbo code)
- Proposal 2: HW complexity should be one of the key criterions for down selection of new channel coding schemes in RAN1. Details on how to do down selection should be discussed.
- Proposal 3: In addition to HW complexity, other factors such as encoding/decoding latency and performance at extremely low error rate that relate to 5G KPIs should be considered.
- Proposal 4: Flexibility related to code block size and code rate are important aspects to be considered when determining the channel coding scheme for 5G new air interface. RAN1 should discuss how to capture this aspect in the study item phase.
- Proposal 5: Determine parameters for evaluation of new channel coding schemes for 5G new interface considering different requirements for eMBB, URLLC, and mMTC. Initial evaluations can be done using QPSK modulation in AWGN channel considering
- Proposal 6: Approve the set of parameters for evaluation in Table 2 as a starting point
- Proposal 7: Approve the evaluation and selection procedures:
  - Evaluate the feasibility of implementation and down-select first
  - Decide clear definitions for flexibility and evaluation parameters

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- Evaluate the coding performance for down-selected proposals and select the most adequate

Decision: The document is noted.

R1-162896 Channel coding requirements for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by Keeth Jayasinghe from Nokia.

Proposal 1: Different requirement shall be considered to select the channel coding scheme or schemes for next generation radio technologies. Key requirements of each usage scenario of next radio access can be identified as in the following table:

eMBB	mMTC	URLLC
Good error performance with high throughput	Good error performance with low throughput	Very good error performance with low/medium throughput
High energy efficiency	Simple implementation	Low latency encoding/decoding
High chip area efficiency	High energy efficiency	Very low error floor
Low latency encoding/decoding		

Proposal 2: Single channel coding scheme from Turbo, LDPC, and Polar shall be selected for eMBB.

Proposal 3: mMTC and URLLC usage scenarios should consider the channel coding scheme to be adopted for eMBB as the baseline, and adopting a different channel coding scheme than for eMBB should only be introduced if compelling benefits are identified.

Proposal 4: mMTC and URLLC usage scenarios shall adopt simple channel coding scheme if it is different from the eMBB channel coding scheme.

Decision: The document is noted.

R1-163274 Evaluation methodology for 5G New Radio channel coding Nokia, Alcatel-Lucent Shanghai Bell

Decision: The document is noted.

R1-162162 High level comparison of candidate FEC schemes for 5G Huawei, HiSilicon

The document was presented by Carmela Cozzo from Huawei and shows a preliminary comparison of some FEC candidates for the new radio, specifically on Polar Code compared to the LTE Turbo Code and Tail-biting Convolutional Code (TBCC).

Decision: The document is noted.

R1-162230 Discussion on channel coding for new radio interface ZTE

The document was presented by Huaming Wu from ZTE.

- Proposal 1: TBCC and its performance improvement should be considered for short packet transmission.
- Proposal 2: Binary and Non-binary LDPC codes should be considered for eMBB in the new RAT.
- Proposal 3: Polar code and its application in the new RAT is FFS.
- Proposal 4: Packet coding should be considered for the new RAT to improve error correction and HARQ performance while reducing decoding complexity and latency.
- Observation 1: Turbo code may not be suitable for the case of large bandwidth, high reliability and short packet transmission.
- Observation 2: Packet coding has better performance and steeper slope performance curve. It is very suitable for high throughput scenarios with high reliability.
- Observation 3: Packet coding can reduce the complexity and latency of encoders & decoders, while keeps the same performance of transmission packet as a long codeword. The packet coding can be used in low complexity and low latency Scenarios.

Decision: The document is noted.

R1-162397 Outer erasure code Qualcomm Incorporated

The document was presented by Tingfang Ji from Qualcomm.

- Proposal 1: Outer erasure codes should be considered as part of 5G SI
- Proposal 2: To use outer erasure code to combat bursty puncturing/interference to achieve high efficiency, reliability with low latency and low uplink feedback and downlink signaling overhead
- Proposal 3: To use outer erasure code to reduced latency and buffering requirements
- Proposal 4: To use outer erasure code over broadcast channel to combat bursty interference, time selective fading and shadowing
- Proposal 5: Outer erasure codes should be designed with rate compatibility, support outer HARQ on top of PHY inner HARQ. Erasure coding and the corresponding outer HARQ process can be enabled/disabled efficiently with low signaling overhead
- Proposal 6: Outer erasure code performance should be evaluated based on key metrics such as spectrum efficiency, reliability, latency, overhead and encoding/decoding complexity

Decision: The document is noted.

R1-162797 HARQ enhancement for improved data channel efficiency MediaTek Inc.

The document was presented by … from MediaTek.

- Observation 1: Single HARQ partition per TB in LTE will suffer large retransmission penalty for future large TB sizes.

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- Proposal 1: Finer ACK/NACK partition in a TB for the chance of eliminating retransmissions of correct data in a TB.
- Proposal 2: Allow retransmission data of a HARQ process to be multiplexed with new data of another HARQ process in the same transmission.
- Proposal 3: Impose proper correlation between the encoder outputs of retransmission data and new transmission data multiplexed in the same transmission so that new transmission data volume can be increased by partly leveraging retransmission combing gain.

Decision: The document is noted.

R1-163232 Performance study of existing turbo codes and LDPC codes Ericsson

The document was presented by Yufei Blankenship from Ericsson.

- Finer granularity in LTE turbo code rate provides system-wide performance advantage, especially for the low code rate regime.
- Incremental-redundancy based HARQ available to LTE turbo codes has great performance advantage, compared to 802.11n LDPC codes with Chae combining only.
- With the same set of (code rate, info block length), 3GPP LTE turbo code and 802.11ad LDPC codes achieve comparable performance.
- With the same set of (code rate, info block length), 3GPP LTE turbo code requires much fewer iterations compared to the LDPC code defined for IEEE 802.11ad.

Decision: The document is noted.

R1-163130 Considerations on channel coding for NR CATR

The document was presented by … from CATR.

- Observation 1: Coding schemes for NR should support variety TBS, flexible coding rates selection, low decoding error rate and fast decode.
- Proposal 1: Coding schemes for control channel, broadcast channel and data channel should be designed independently.
- Proposal 2: In NR, error floor should be avoided for high reliability transmission.
- Proposal 3: Decoding latency, data storage and power consumption should be carefully evaluated to make coding schemes selection.
- Proposal 4: RM, TBCC, Polar code could be considered for broadcast and control channel.
- Proposal 5: Turbo, LDPC and Polar code could be considered for data channel.

Decision: The document is noted.

R1-163662 Way Forward on Channel Coding Scheme for 5G New Radio Samsung, Nokia, Qualcomm, ZTE, Intel, Huawei

- Candidates for 5G new RAT data transmission are identified as the following
  - LDPC code
  - Polar code
  - Convolutional code
- Selection of 5G new RAT channel coding scheme(s) will consider,
  - Performance
  - Implementation complexity
  - Latency (Decoding/Encoding)
  - Flexibility

Decision: The document is noted and modified as follows:

Agreements:

- Candidates for 5G new RAT data transmission are identified as the following
  - LDPC code
  - Polar code
  - Convolutional code (LTE and/or enhanced convolutional coding)
  - Turbo code (LTE and/or enhanced turbo coding)
  - Note: It is RAN1 common understanding that combination of above codes is not precluded
  - Note: Outer erasure code is not precluded
- Selection of 5G new RAT channel coding scheme(s) will consider,
  - Performance
  - Implementation complexity
  - Latency (Decoding/Encoding)
  - Flexibility (e.g., variable code length, code rate, HARQ (as applicable for particular scenario(s)))

The document was presented by … from … and .

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Discussion: .
Decision: The document is noted.

R1-162161 Overview of Polar Code Huawei, HiSilicon
R1-162798 5G High Throughput and Low Power Consumption Codec MediaTek Inc.
R1-162160 Motivation of 5G New FEC Huawei, HiSilicon
R1-162208 Requirements and evaluation Qualcomm Inc.
R1-162209 LDPC - HARQ, rate Qualcomm Inc.
R1-162210 LDPC - throughput latency block size Qualcomm Inc.
R1-162211 Polar - HARQ, rate Qualcomm Inc.
R1-162212 Polar - throughput latency block size Qualcomm Inc.
R1-162213 TBCC - HARQ, rate Qualcomm Inc.
R1-162214 TBCC - throughput latency block size Qualcomm Inc.
R1-162309 Channel coding for the 5G new radio CATT
R1-162387 Channel coding for new radio interface Intel Corporation
R1-162520 Discussion on channel coding for NR LG Electronics
R1-162897 Performance and complexity of Turbo, LDPC and Polar codes Nokia, Alcatel-Lucent Shanghai Bell
R1-162898 Channel coding for URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-162927 Design considerations on channel coding with very large blocklength INTERDIGITAL COMMUNICATIONS
R1-162928 Design considerations on channel coding with short blocklength INTERDIGITAL COMMUNICATIONS
R1-163114 Channel Coding for NR NTT DOCOMO, INC.
R1-163231 On channel coding for NR Ericsson
R1-163329 Candidates of channel coding schemes for New RAT KT Corp.

8.1.6.2 Modulation

R1-162163 Applying Multi-Dimensional Modulation to Non-Orthogonal Multiple Access Huawei, HiSilicon
The document was presented by Wang YI from Huawei.

- Observation 1: Multi-dimensional modulation provides significant spectral efficiency improvement compared to linear spreading, especially when higher-order modulation is used.
- Observation 2: Multi-dimensional modulation provides lower detection complexity by allowing lower number of projection points compared to linear spreading.
- Proposal: Further consider multi-dimensional modulation for non-orthogonal multiple access scenarios in 5G.

Decision: The document is noted.

R1-162521 Discussion on modulation schemes for NR LG Electronics
R1-162923 Discussion on Modulation for New Radio systems INTERDIGITAL COMMUNICATIONS

Not treated.
R1-162215 NR modulation requirements Qualcomm Inc.
R1-162216 Candidate NR modulation schemes Qualcomm Inc.
R1-162899 Digital Modulation for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-163233 On modulation schemes for NR Ericsson

8.1.7 Other

8.2 Study on channel model for frequency spectrum above 6 GHz - SID in RP-151606

R1-162191 Chairman's Notes of Agenda Item 8.2 on Channel model for >6 GHz Nokia
Discussion:
Decision: The document is return in Fri common session

Offline session notes

R1-163482 Minutes of offline session on Tuesday Nokia
Discussion:
Decision: The document is noted

TR update

R1-162710 TP for TR38.900 Section 7.1 - coordinate systems Samsung, Nokia

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Discussion:
Decision: The document is agreed

R1-162711 **TP for TR38.900 Section 7.2 and 7.3 - scenarios and antenna modeling** **Samsung, Nokia**

Discussion:

ZTE: For indoor office and shopping mall, do you assume multi floor case?
Samsung: No
ZTE: We need many floors for the calibration. Are we going to increase the number of floors in the future?
Samsung: It can be discussed in the future. This TP is for scenarios and antenna modelling.

Decision: The document is agreed

R1-162712 **TP for TR38.900 Section 7.4 - pathloss, LOS, O-I modeling** **Samsung, Nokia**

Discussion:

Ericsson: One issue on LOS PL discontinuities need to be captured.
Samsung: This is based on working assumption from last meeting. Further changes can be made during this meeting if needed.
ZTE: 7.4.1.1 note says the central frequency. PL f is not going to be fc if BW is large.
Samsung: That is a typo.

Decision: The document is revised in 3468

R1-163468 **TP for TR38.900 Section 7.4 - pathloss, LOS, O-I modeling** **Samsung, Nokia**

Discussion:

Decision: The document is agreed

R1-162713 **TP for TR38.900 Section 7.5 - fast fading** **Samsung, Nokia**

Discussion:

Ericsson: LSP has strong frequency dependencies. We are not comfortable with that.
Samsung: This is based on working assumption from last meeting. Changes can be reflected in the next version.
Ericsson: We prefer brackets instead.
Nokia: We agree with Samsung. This is based on working assumption. Of course that need to be confirmed.

Decision: The document is agreed

R1-162714 **TP for TR38.900 Section 7.6 - additional modeling components** **Samsung, Nokia**

Discussion:

ZTE: Oxygen loss offset need to be clarified. Is it LOS distance? Is it deterministic or random?
Samsung: TP is based on agreements from last meeting.
Nokia: Calculation in Keysight document is not entirely correct.
CATT: Examples are not clear.
Huawei: We also found some errors in Keysight calculations. We could take this offline to find the correct equation.
Nokia: We should agree this now capturing agreements from last meeting.
Samsung: We could fix the oxygen error

Decision: The document is revised in 3469

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R1-163469 **TP for TR38.900 Section 7.6 - additional modeling components** **Samsung, Nokia**

Discussion:
Decision: The document is agreed

R1-162715 **TP for TR38.900 Section 7.7 and 7.8 - Link-level channel model and calibration** **Samsung, Nokia**

Discussion:
Decision: The document is revised in 3470

R1-163470 **TP for TR38.900 Section 7.7 and 7.8 - Link-level channel model and calibration** **Samsung, Nokia**

Discussion:
Decision: The document is agreed

R1-163396 **Correction in "Large Bandwidth and Large Antenna Array" section of R1-162714** **Keysight**

Mathematical error was found in the new equation to cope "Large Bandwidth and Large Antenna Array" in ***Error! Reference source not found.****. The correction to the problem is proposed in section* ***Error! Reference source not found.****.*

Please, note that the "additional model component" for large bandwidth and large antenna arrays defined in ***Error! Reference source not found.*** *does not solve issues for spherical wave modelling and non–WSS propagation across antenna elements.*

Chair: Tdoc was requested late

Discussion:
Decision: The document is noted

R1-163488 **TP for TR38.900** **Samsung, Nokia**

Discussion:

Huawei: We are OK but comment on fast fading model where distance is km. We could unify the units.
Samsung: WE can correct for the next version

Decision: The document is agreed

8.2.1 Remaining details on large scale modelling for >6GHz

Remaining details on LOS probability, pathloss (including penetration loss) and shadow fading

LOS probability

R1-162522 **Remaining details on LOS probability in indoor open office scenario** **LG Electronics**

Proposal 1: For indoor open office scenario, adopt table 3 for parameterizations.

Discussion:
Decision: The document is not treated

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R1-162716 **LoS probability model for indoor open-office scenario** **Samsung**

Proposal 1: Adopt the proposed LoS probability model for indoor open-office scenario:

$$P_{LoS} = \begin{cases} 1, & d \le 3 \\ \left(e^{-\frac{d-3}{14.6}}\right), & 3 < d \le 21 \\ \left(e^{-\frac{d-21}{69.2}}\right) * 0.15, & d > 21 \end{cases}$$

Discussion:
Decision: The document is not treated

R1-162241 **LOS probability for indoor open office** **Huawei, HiSilicon, AT&T, CMCC, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Observation 1: considering the continuity of the model, the LOS probability model for open office agreed in R1-161727 is of the same form as the LOS probability for mixed office agreed in R1-161640.

Proposal 1: the LOS probability model for indoor open office should be:

$$P_{LOS}^{Open\_office} = \begin{cases} 1, & d \le 5 \\ \exp(-(d-5)/70.8), & 5 < d \le 49 \\ \exp(-(d-49)/211.7) \cdot 0.54, & d > 49 \end{cases}$$

Discussion:
Decision: The document is agreed

Penetration loss

R1-163097 **Additional Considerations on Building Penetration Loss Modeling for 5G System Performance Evaluation** **Straight Path Communications**

Proposal: For building penetration loss modelling, the low-loss model shall be used with 80% probability, the high-loss model shall be used with 10% probability, and a medial loss model (the average of the high-loss and the low-loss model) shall be used for 10% of the probability, with the low-loss model and the high-loss model as defined in R1-161687.

Discussion:
Decision: The document is revised in 3408

R1-163408 **Additional Considerations on Building Penetration Loss Modeling for 5G System Performance Evaluation** **Straight Path Communications**

Proposal 1: The low loss model should be used with 80% probability, the high loss model should be used with 10% probability, and a medial loss model (the average of the high-loss and the low-loss model) should be used for 10% of the probability.

Proposal 2: The low loss model should be used with 80% probability and the high loss model should be used with 20% probability for Urban Micro; the low loss model should be used with 90% probability and the high loss model should be used with 10% probability for Urban Macro.

We request RAN1 to select one of these two proposals for New Radio (NR) system performance evaluation purposes.

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Discussion:
Decision: The document is not treated

R1-163255 **Removing square brackets in the O2I penetration loss modeling** **Ericsson, Nokia, NTT DOCOMO, Samsung**

Proposal 1: Use a value of 5 dB for compensating the path loss through the external wall for non-perpendicular incidence angles

Discussion:
Decision: The document is agreed

R1-163256 **Removing square brackets in the O2I penetration loss modeling, part 2** **Ericsson, NTT DOCOMO, Samsung**

Proposal: Use a standard deviation of 7 dB to represent the variation of the building penetration loss

Discussion:

Decision: The document is agreed

R1-163485 **WF on O2I LSPs** **Ericsson, Huawei, HiSilicon**

Discussion:

Decision: The document is agreed

Path loss modeling

Chair: See also late LS from NYU Wireless in R1-163395 with following findings:

Results show the CI model with a 1-m reference distance is suitable for outdoor environments, while the CIF model is more appropriate for indoor channel modeling. The CI and CIF models are easily implemented in existing 3GPP models by making a very subtle modification—by replacing a floating non-physically based constant with a frequency-dependent constant that represents free-space path loss in the first meter of propagation. This paper shows this subtle change offers better model parameter stability, better accuracy in sensitivity tests over a vast range of microwave and mmWave frequencies, scenarios, and distances, is easier to use in analysis, and has intuitive appeal while using a simpler model with fewer parameters.

R1-163258 **Shortcomings of the proposed LOS path loss models** **Ericsson**

Observation 1: The new LOS path loss models suffer from strong discontinuities at the break point.

Observation 2: The 3D SCM LOS path loss models can represent also the new measurements well due to the similarity of the parameters

Proposal: Adopt the 3D SCM 36.873 LOS path loss models for use in the UMa and UMi scenarios.

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Discussion:

NTT: Does this propose using 3D CM for 6-100 GHz?
Ericsson: Yes.
NTT: We agree with discontinuity problem but higher bands shall be verified also.
Ericsson: Both models have the same frequency dependence.
NTT DOCOMO: We should indicate actual estimation accuracy.
ZTE: If we change the PL model how about SF then?
Ericsson: We have inconsistency also with SF.
Huawei: We have a late contribution on how to solve this.

Decision: The document is noted

R1-162231 Comparison of CIF vs. ABG model for pathloss modeling Qualcomm Inc.

Proposal: While the CIF and ABG models lead to comparable fits in modeling the path loss, the ABG model is poorer than the CIF model on two counts: i) more parameters are used in the ABG model than the CIF model, ii) the ABG model is more unstable than the CIF model in predictive power. Thus, the CIF model should be used for capturing path loss in >6 GHz channel modeling.

Discussion:
Decision: The document is not treated

R1-162310 Discussion on NLOS path loss modeling CATT

Proposal: For NLOS path loss channel modelling, the close-in model may be preferable for its physics basis.

Discussion:
Decision: The document is not treated

R1-162570 Comparing ABG and CI pathloss model Nokia, Qualcomm, Alcatel-Lucent Shanghai Bell

Observation-1: The close-in (CI) reference distance path loss model does a significantly better job at predicting path loss performance in frequency, distance, and across environments.

Observation-2: The CI path loss model has a much more stable parameterization than the alpha-beta-gamma (ABG) path loss model when determining the parameters on different sets of distances, frequencies, and environments.

Observation-3: A linear modeling of the increase or decrease with the log of frequency does not accurately model real world conditions.

Proposal: Adopt the CI path loss model for both LOS and NLOS conditions for at least the outdoor channels.

Discussion:

AT&T: Conclusion says outdoor only?
Nokia: We mean at least for outdoor. It should be sufficient also for indoor.
NTT DOCOMO: We should use ABG model.
Qualcomm: We have analysed also indoor case in our document.
Ericsson: You say linear modeling is invalid but also CI model in linear. It is actually worse than ABG model. It does not model the reality accurately.
Nokia: Our observation is based on the measurement data. Prediction capability is important aspect.
AT&T: We could go with CI for LOS and ABG for NLOS cases.
Nokia: That is a good point. Both models have their merits. We need to make progress in this meeting.

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Huawei: We also have similar thinking on usage cases.
ZTE: For LOS either one is fine but for NLOS case the ABG is better.
Nokia: We support CI as we don't have enough measurement data. Gamma value is not stable.

Decision: The document is noted

R1-162571 System level simulation using ABG and CI modelling Nokia, Alcatel-Lucent Shanghai Bell

Discussion:
Decision: The document is withdrawn

R1-162425 Path loss model for indoor environment NTT DOCOMO, NTT

Proposal: If ABG model is used for indoor NLOS case, single slope model is used.

Discussion:
Decision: The document is not treated

R1-162717 Discussion on pathloss modeling for UMi NLoS environment Samsung

Proposal: Keep the ABG formula used in ITU and 3GPP pathloss model for the consistent modeling, and there is no significant reason to change the formula from ABG model to CI model

Discussion:
Decision: The document is not treated

R1-162989 38GHz Pathloss Model for UMi Scenario Street Canyon Scenario ITRI, MediaTek Inc.

Proposal 1: For LOS case, the working assumption model [1] is quite close to our 38GHz data fitted model.

Proposal 2: For NLOS case, the ABG model can provide better modeling accuracy than CI model.

Proposal 3: The measurement results and fitted parameters can be captured in the TR.

Discussion:
Decision: The document is not treated

R1-162247 Path loss modeling for NLOS propagation Huawei, HiSilicon, Ericsson, NTT DOCOMO, Samsung

Proposal 1: for NLOS propagation case, the pathloss model in ***Error! Reference source not found.*** *should be adopted as working assumption.*

Proposal 2: The inclusion of path loss dependency on the UE and eNB height similar to that in the 3D SCM model should be further considered

Proposal 3: The consistency with the 3D SCM model for below 6 GHz should be further considered

Discussion:

Nokia: We found ABG model with small distance better than free space PL. What is the explanation on that?
Ericsson: Behaviour is the same also for CI model.
Huawei: We propose the dual slope for indoor.
NTT DOCOMO: Does table 6 propose a frequency and distance range? Do you capture the range in a TR?
Huawei: These are based on measurements. We plan to capture in a TR.

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Ericsson: Proposal 1 may be controversial. Can we agree on proposals 2 and 3?
Nokia: Consistency is important but could be studied in future work items.

Decision: The document is noted

R1-163428 Amendment for LOS pathloss working assumption Huawei, HiSilicon

Chair: Late contribution

Proposal: the LOS pathloss in table can be agreed.

Discussion:

Ericsson: Original 3D model distance dependency is consistent with physics. This is not a physical behaviour.

Decision: The document is noted

R1-163471 WF on pathloss modeling Nokia

Discussion:

Chair: In offline discussion the status was as follows
Alt.1 is objected by Huawei
Alt.2 is objected by Ericsson, Qualcomm
Alt.3 is objected by Nokia, Qualcomm

Huawei: We also prepared a WF. We could ask supporting companies.
Nokia: We need to find a compromise solution so we prefer to ask objecting companies.
Huawei: We agree we need to find a compromise. That's why we proposed another way.
NTT DOCOMO: We may be able to agree step by step with different scenarios.
Qualcomm: We are OK to work with alternative 2 as well.
Ericsson: Alt 2 UMa model is CI. This is incomplete proposal regarding UE height. We are happier with Alt 1.
Nokia: ABG model do not have UE height dependency either. We could make Alt 2 as working assumption. We could confirm that on May meeting.
Ericsson was not OK at this point of time.
Samsung: We need to start the calibration in this meeting. PL issues shall be agreed in this meeting. We encourage companies to compromise.
Nokia: Alt 2 as working assumption. UE height to be clarified in the next meeting.
Ericsson: We could say the same also for Alt 1.
Nokia can live also with Alt 1.
Qualcomm: We should down select and make the progress.
Huawei: We have 9 supporting companies for Alt 3. That is majority view from our point.
Nokia: Huawei's WF is already captured but this is consensus based group.
Huawei: We should check the least restrictive alternative.
Ericsson: We could start with alternative with majority support which is Alt 3.
Nokia: That is not a compromise.
CATT: We could take 873 3D CM approach as a working assumption.
Nokia: How should we do work based on that?
Ericsson: FFS would be adapting parameters with new measurements.
Nokia: We can further compromise. Alt 1 with indoor scenario with both ABG and CI models.
Huawei: That is confusing. We should treat all scenarios in a similar way together.
Samsung: We are not treating scenarios in a different way.

Decision: The document is revised in 3486

R1-163486 WF on pathloss modeling Nokia

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Discussion:

Decision: The document is revised in 3637

R1-163637 WF on NLOS pathloss for UMa, Umi-Street Canyon and Indoor-office Nokia, Samsung, CATT, Ericsson, NTT Docomo, Intel, Qualcomm, ZTE

Discussion:

ZTE: 1st bullet has FFS. Models in 2nd bullet can be changed.
Nokia: Yes

Decision: The document is agreed

R1-163483 WF on LOS pathloss model Huawei, HiSilicon

Discussion:

Nokia: You propose 3D UMa for LOS. What is your consideration on >6GHz
Huawei: We believe the information based on measurements is useful
Nokia: Can we agree this together with our WF?
Huawei: This tries to solve the working assumption. These are separate issues.
Ericsson: We propose to re-use 3D CM for Uma and UMi LOS. This is different approach.
Huawei: We have introduce lot of new measurements >6GHz.
Nokia: We did not compare the LOS case for 3D CM applicability for >6GHz.
Ericsson: We did compare the LOS case with 3D CM with CI model with new measurements and the match is pretty good.

Decision: The document is noted

R1-163484 WF on NLOS pathloss model Huawei, HiSilicon, Ericsson, ETRI, Fraunhofer HHI, Keysight, LGE, Samsung, Spirent

For NLOS pathloss
- *For UMi-Street Canyon, adopt ABG model*
- *For Indoor-office, adopt ABG single slope model*
- *For UMa, adopt ABG model*

Discussion:

Nokia: We cannot accept this which is actually alt 3 in our WF.
Huawei: It is and preferred way for sourcing companies.
NTT DOCOMO: WE can support this WF.

Decision: The document is noted

Rural Macro model

R1-163640 WF on RMa model Ericsson

Adopt the ITU-R M.2135 Rural Macro model for rural macrocell simulations
Enhance the RMa model to 3D using elevation parameters taken from the 5G UMa model
Tuning of the elevation parameters is FFS
For example, the elevation angle spread is expected to be lower in rural scenarios
Capture the model in the TR by reference to M.2135 + a table with the additional parameters
Put square brackets around the "UMa" parameters pending further tuning

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Discussion:

Samsung: This is good starting point. This seems to be out of scope as CM SI scope is for >6GHz.
Nokia: Do we really have to extend it to 3D? If not we could use ITU CM.
Samsung: ZoD distribution is going to be challenging but there are some merits on this. We can utilize elevation beamforming. It would be good to assume 3D CM for RMa.
Nokia: Antenna heights are higher for rural deployment. We cannot simply re-use 3D CM parameters for RMa.
Ericsson: WE agree. We need to tune them. Antenna height is 35 m. It is small effort compared to UMa 25 m.
Samsung: We can discuss this in the main NR session as this is out of the scope of CM SI.
Ericsson: 5G evaluation need CM also for RMa. Who does CM for <6GHz if we don't?
Nokia: We are neutral. It would be good to include but we have already agreed 5 scenario for the SI.
Sharp: We agree with Nokia but also sympathize the Ericsson proposal. CM is needed ASAP.
Ericsson: Doing this in NR session instead then we do we document this?
Huawei: Would it be possible to postpone to decision for the next meeting. We need to understand operatos positions better.
Nokia: If we need to extend the scope that need to be decided in plenary.
Samsung: SI is for >6GHz. Rural is for <6GHz.

Decision: The document is noted

8.2.2 Remaining details on fast fading modelling for >6 GHz

Remaining details on large scale, small scale parameters, channel generation steps, etc.

Measurements

R1-163252 **New InH measurements of the frequency dependence of delay spread** **Ericsson, Telstra**

Proposal: Delay spread modeling in the InH scenario should be frequency independent

Discussion:
Decision: The document is not treated

R1-163257 **Requirements for Comparability of Radio Channel Measurements** **Ericsson**

Proposal: When comparing different measurement data at different frequencies and/or from different campaigns the following requirements should be fulfilled:

1. *The same measurement bandwidth should be used*
2. *Equal antenna pattern should be used (may also be synthesized)*
3. *Equal dynamic range should be used, both in delay and angle domains*
4. *When the channel is sampled in space the same volume in terms of number of wavelengths should be used*
5. *The environment should be equal i.e. same location and same variability in terms of moving people and vehicles etc.*
6. *Locations of antennas should be the same*
7. *The oxygen absorption at 60 GHz should be compensated for using propagation path lengths as agreed in* ***Error! Reference source not found.****. This is important for securing smooth frequency properties when extrapolating/interpolation using 60 GHz.*

Discussion:
Decision: The document is not treated

Channel generation

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R1-162576 Joint proposal on fast fading channel generations Samsung, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm

Proposal 1: Adopt the full detailed method of channel generation steps in Section 7.3 of TR36.873 at least in the following cases:

- *Case 1: For low complexity evaluations*
- *Case 2: To compare with earlier simulation results,*
- *Case 3: When none of the additional modeling components are turned on.*
- *Other cases are not precluded*

Proposal 2: Modification of the steps in the other cases can be further studied.

Discussion:
Decision: The document is agreed

R1-162954 Text proposal to TR 38.900 to add channel coefficient generation procedures Huawei, HiSilicon

This contribution proposes some content to the 12 steps in section-2 in TR36.873.

Discussion:

CATT: Changing BS and UE to TX and RX that will impact on many other places as well. Maybe better to leave as is.
Intel agree with CATT.
ZTE: We support this change. CATT comment is editorial issue which can be considered later if needed.
Ericsson: Intention is good but there is a problem. BS could be TX and RX. We have different parameters in BS and UE side.
Huawei: We can clarify if requirement is for UL or DL but we need to consider also UE to UE aspects.
Nokia: In general we support the change but we also agree with Ericsson. We can agree this in later phase.

Decision: The document is noted

R1-162957 Text proposal to TR 38.900 to add dual mobility Doppler Huawei, HiSilicon

This contribution proposes some content to the 12 steps in section-2 in TR36.873.

Discussion:

Samsung: It is not clear when should we apply this. More considerations are needed. We can clarify this later.

Decision: The document is noted

Large scale parameters

R1-162311 Analysis on measurement data and proposed modeling CATT

Proposal 1: The azimuth and zenith angular spread of arrival may have the same tendency corresponding to increasing frequency.

Proposal 2: More data should be used to get the proper values of α *and* β *for the fitting equation* $\alpha 10(1+f)+\beta$.

Proposal 3: Since 30GHz and 70GHz could be target frequency for system simulation, at least the parameters for these two frequencies should match the measured data.

Discussion:
Decision: The document is not treated

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R1-162572 Refinement on UMa LSP Nokia, Samsung, AT&T, CMCC, Ericsson, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm

Proposal: For UMa, adopt the large-scale parameters from [2] with Tables 5 and 12 replaced with the ones from this contribution.

Discussion:
Decision: The document is agreed

R1-162719 Discussion on large-scale parameters in indoor office environment Samsung

Proposal: For indoor office scenario,

- *Adopt the LS parameters in Table 2.*
- *Adopt the LS cross-correlation parameters from IMT-Advanced channel model in ITU-R M.2135.*

Discussion:

Ericsson: Table 2 summary summaries only some frequency bands. We have considered constant values in other scenarios. Have you compensated oxygen loss in 60 GHz?
Samsung: This table is for information. We are not considering frequency dependency. No compensation for oxygen loss.
Huawei: We could capture this data in the future.

Decision: The document is noted

R1-162956 Discussion on the sum-of-sinusoids based LSPs Huawei, HiSilicon

Observation: Sum-of-sinusoid method provides spatially consistent LSPs such as shadowing with reasonable complexity.

Discussion:
Decision: The document is not treated

R1-162232 Indoor and outdoor measurements on frequency-dependent delay spreads Qualcomm Inc.

Proposal: Frequency dependent models for large scale parameter(s) appear to be intuitive and measurement results support this intuition. In particular, frequency dependent delay spread models should be considered for >6 GHz channel modeling.

Discussion:
Decision: The document is not treated

R1-163253 On the frequency dependence of LSPs in reported UMi and InH measurements Ericsson

Proposal: Use a functional form for frequency dependence of LSPs and SSPs containing a constant term and a frequency-dependent term of the following form: $\boldsymbol{LSP = a + [b] \cdot function(f)}$*, where the strength of the frequency-dependent term is FFS*

Discussion:
Decision: The document is not treated

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R1-163254 On the frequency dependence of LSPs Ericsson

Proposal: Use a functional form for frequency dependence of LSPs and SSPs containing a constant term and a frequency-dependent term of the following form: $\boldsymbol{LSP = a + [b] \cdot function(f)}$*, where the strength of the frequency-dependent term is FFS*

Discussion:

Qualcomm: We have done measurement and we have seen frequency dependency. More analysis is still needed.
ZTE: Do LSP refer to one parameter or two parameters?
Ericsson: We should be careful while specifying frequency dependency. We have separate contribution on measurements in R1-163257.
CATT: Our measurement campaign in indoor scenarios observe frequency dependency

Decision: The document is noted

Small scale parameters

R1-162243 Discussion on frequency dependent SSP Huawei, HiSilicon

Proposal 1: for indoor office, frequency dependent cluster ASA and cluster ZAS should be modelled.

Discussion:

Ericsson: We cannot find the info on used antenna.
Huawei: Wide beam for RX and rotation 10 degree horn antenna for TX.

Decision: The document is noted

Large and small scale parameters

R1-162242 Large-scale and small-scale channel modeling for outdoor to indoor scenario Huawei, HiSilicon

Proposal1: the O-to-I large-scale and small-scale parameters should be modified due to new measurement above 6GHz.

Proposal2: the O-to-I model parameters could be adopted as defined from ***Error! Reference source not found.*** *to* ***Error! Reference source not found.*** *for UMi and UMa scenarios.*

Discussion:
Decision: The document is not treated

R1-162246 Large-scale and small-scale channel modeling for indoor hotspot Huawei, HiSilicon, AT&T, CMCC, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung, ETRI

Proposal 1:.for indoor office, the recommended LSP from Table 1 to Table 4 should be adopted for large-scale channel modeling of this SI.

Proposal 2:.for indoor office, the recommended SSP in Table 5 and Table 6 should be adopted for cluster-level small–scale channel modeling of this SI.

Discussion:
Decision: The document is revised in 3427

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R1-163427 Large-scale and small-scale channel modeling for indoor hotspot Huawei, HiSilicon, AT&T, CMCC, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung, ETRI

Proposal 1:.for indoor office, the correlation distance and cross correlation of LSP in IMT-A can be reused for azimuth domain channel characteristics. The recommended LSP from Table 1 to Table 4 should be adopted for large-scale channel modeling of this SI.
Proposal 2:.for indoor office, the number of rays per cluster and per cluster shadowing in IMT-A can be reused. The recommended SSP in Table 5 and Table 6 should be adopted for cluster-level small–scale channel modeling of this SI.

Discussion:

ZTE: Table 5 and 6 mention number of clusters. We think 4 is small number. Table 3 => 3rd number from the bottom gives a negative value.
CATT: Number of clusters are small. Listed results are not complete. Table 1 frequency dependency requires further studies.
Huawei: We can update frequency dependency in the future. Values as in brackets.
Ericsson: Number of clusters could also be in brackets.

Decision: The document is revised in 3472

R1-163472 Large-scale and small-scale channel modeling for indoor hotspot Huawei, HiSilicon, AT&T, CMCC, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung, ETRI, CATT

Proposal 1:.for indoor office, the correlation distance and cross correlation of LSP in IMT-A can be reused for azimuth domain channel characteristics. The recommended LSP from Table 1 to Table 4 should be adopted for large-scale channel modeling of this SI.
Proposal 2:.for indoor office, the number of rays per cluster and per cluster shadowing in IMT-A can be reused. The recommended SSP in Table 5 and Table 6 should be adopted for cluster-level small–scale channel modeling of this SI.

Discussion:

ZTE: You changed to fixed number which is not frequency dependent at all.

Decision: The document is agreed

R1-162718 Updated joint proposal on large-scale and small-scale parameters for UMi scenario Samsung, AT&T, CMCC, Ericsson, Huawei, HiSilicon, Intel, KT Corporation, Nokia Networks, NTT DOCOMO, Qualcomm, ETRI

Proposal 1: For UMi Street canyon, adopt the updated delay spread model in Table 1 and the updated ZoD model in Table 2 to replace the proposal in [1]

Proposal 2: The current K-factor parameters in 3D-SCM UMi can be reused for UMi Street canyon scenario.

Proposal 3: For UMi Street canyon, adopt the correlation distance parameters in Table 3

Proposal 4: For UMi Street canyon, adopt the cross-correlation parameters in Table 4, which parameters are taken from 3GPP 3D-SCM UMi scenario

Discussion:

ZTE: Cross correlation table, is it assumption or observation?
Samsung: Correlations are analysed in Annex. There is no strong frequency dependency.

Decision: The document is agreed

R1-163251 Modelling of LSPs and SSPs for the outdoor to indoor propagation Ericsson, Nokia Networks, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung

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Proposal 1: Adopt the first or the second approach for the LSP and SSP parameters for the outdoor to indoor links in the UMa and UMi scenarios

Proposal 2: Consider further modifications of the LSPs if additional O2I measurement data is made available

Discussion:
Decision: The document is agreed

Clustering

R1-162233 Clustering methodology and results for indoor and outdoor scenarios Qualcomm Inc.

Proposal 1: The design of good beamforming protocols differ significantly depending on whether a small/large number of clusters capture the multi-antenna channel. Reusing 36.873 parameters for number of clusters should be done with precaution.

Proposal 2: Mixing ray tracing data with measurements in determining cluster statistics is not a good idea.

Proposal 3: Given the extensive measurements on azimuthal and spherical scans performed at Qualcomm at millimeter wave frequencies, Qualcomm's data on indoor office and shopping mall should be included in further studies that lead to development of cluster statistics for > 6 GHz channels.

Discussion:
Decision: The document is not treated

R1-162994 Implementation of cluster delay spread NTT DOCOMO, NTT

Proposals 1: The Alternative 1 and 2 can be used for the case of channel bandwidth is narrow with low complexity of implementation

Proposals 2: The Alternative 3 can be beneficial for various channel bandwidths with low complexity of implementation.

Proposals 3: The Alternative 4 should be used for the case of requirement for high accuracy of channel with various bandwidths.

Discussion:
Decision: The document is not treated

R1-163115 A hierarchical agglomerative clustering algorithm for channel modelling Intel Corporation, Ericsson, Nokia Networks, AT&T, CMCC, ETRI, Huawei, HiSilicon, KT Corporation, NTT DOCOMO, Qualcomm, Samsung, University of Southern California

This contribution illustrates the merits of the HAC algorithm:

- *It jointly processes delay, angle and space information for clustering MPCs.*
- *It is able to find compact, yet not necessarily convex, clusters in delay-angular domain and it does so without excluding the presence of outliers.*
- *Low sensitivity with respect to the resolution of the input data, thus ensuring consistent results across measurements taken in the same environment but with different resolutions.*
- *It produces spatially consistent clusters.*
- *It allows to cluster MPCs disregarding on whether these are fully specified both in angle and delay domain.*

Discussion:

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Decision: The document is agreed

Time variation

R1-163246 Channel modeling with time-varying delays and angles Ericsson

Proposal: Modify the equivalent of equation (7.21) in ***Error! Reference source not found.*** *in the new model according to the suggestion in section* ***Error! Reference source not found.****.*

Discussion:
Decision: The document is not treated

R1-163636 WF on modeling of time-varying angles Ericsson

Proposal 1: Replace the factor in the channel coefficient equation

Field Code Changed

Proposal 2: Proposal 1 needs only to be considered in case the Doppler frequencies are time-varying. This could be due to:

Non-linear UE movement

Time-varying angles of arrival due to spatial consistency modeling

Discussion:

Sharp: Does this work for wideband scenarios?
Ericsson: We are not sure actually. Doppler could change over the BW.
Intel: What mobility model is used? Anchor point could be related to phase discontinuity.
Ericsson: Simulations were done with 873 implementation. We should not get phase discontinuity.
Samsung: Which part in the current TR you want to change?
Ericsson: That is up to rapporteur.
Intel: UE moving around the circle the values change.
Nokia: Updating anchor point for non-linear movement. How often to update anchor point?
Ericsson: There is a criteria for that.
ZTE: When to use this?
Ericsson: Whenever the Doppler frequencies are not constant.
Huawei: Title should be time varying Doppler. Which frequency was assumed? We have concerns on non-linear movement.
Ericsson: Title can be changed. Non-linear movement is only one example.
LGE: Are you suggesting this to drop based model?
Huawei: More time is needed to check results.

Decision: The document is noted

8.2.3 Remaining details on modelling of additional features for >6GHz channel model

8.2.3.1 Remaining details on blockage modelling

R1-162234 TP on Dynamic Blockage Modeling Qualcomm Inc.

Propose (TP) the parameters for modeling dynamic blockage according to a stochastic model.

Discussion:

Intel: Basically this is similar view than ours except some parts.
CATT: LOS and NLOS states to be considered. Blocking should not be lower than NLOS.

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Interdigital. We agree with this except some parameters.
Samsung: We need further discussion in this area.

Decision: The document is noted

R1-162312 **Clarification on blocking model CATT**

Discussion:
Decision: The document is withdrawn

R1-162573 **Remaining details on blockage modelling Nokia, Alcatel-Lucent Shanghai Bell**

Discussion:
Decision: The document is revised in 3381

R1-163381 **Remaining details on blockage modelling Nokia, Alcatel-Lucent Shanghai Bell**

Proposal-1: Consider K+1 blockers for each user where K blockers to mimic the blockage effect due to moving objectives around the UE and one blocker to mimic the blockage effect due to very close range of obstacles to the UE (self-blockage)
Proposal-2: The one blocker for self-blockage doesn't need to be consistent in spatial domain. The K blockers for surrounding objectives should be spatially consistent. The centers of K blockers are generated by correlation grids with corresponding blockage correlation distance and interpolation.
Propsoal-3: A single blocking radius (fixed or statistical) is applied per cluster.
Proposal-4: The centers of blockage shall be temporally consistent by using a 3D (spatial/temporal) correlation grid.
Proposal-5: Enabling blockage modeling shall not dramatically change large scale parameters specified for each scenario.
Proposal-6: Focusing on remaining modeling parameters listed in open issues

Discussion:
Decision: The document is not treated

R1-163078 **Power Attenuation in Dynamic Blockage INTERDIGITAL COMMUNICATIONS**

Proposal 1: Consider the second approach in Proposal A5 in ***Error! Reference source not found.*** *and use the log-normal distribution for shadowing loss.*

Discussion:
Decision: The document is not treated

R1-162523 **Remaining details on blockage modeling for channel modeling >6GHz LG Electronics**

Proposal 1: The temporal consistency should be modeled for blockage modeling only in case of assuming severe transition of test environment such as radio link failure test. Other condition is not precluded and further study might be needed.
Proposal 2: Considering implementation complexity, it is preferable to adopt simple interpolation-based approach in option 2.
Proposal 3: The decorrelation time for center of blocking region would be different between far-field and near-field blockage.

Discussion:
Decision: The document is not treated

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R1-162388 **Remaining details on blockage modelling Intel Corporation**

Proposal 1: The additional shadowing of one blocker should consider the link between the transmitter and the blocker for indoor scenario as in equation (2-1).
Proposal 2: When calculating the additional shadowing on the LoS channel cluster, the blocker model including center and span, can still be built in the receiver's polar coordinate system. Then the blocker model in the transmitter's coordinate system can be derived by center ($\boldsymbol{\varphi_{Rx} - \pi, \pi - \theta_{Rx}, r_{Tx}}$), azimuth angular span $\boldsymbol{A_{Rx} r_{Tx}/r_{Rx}}$, zenith angular span $\boldsymbol{Z_{Rx} r_{Tx}/r_{Rx}}$.
Proposal 3: For NLoS channel cluster, a virtual transmitter can be assumed at the extension line of AoA/ZoA.
Proposal 4: The additional shadowing on the NLoS channel cluster can be calculated based on the link between virtual transmitter and receiver in the same way as LoS channel cluster.
Proposal 5: The distance between the virtual transmitter and the blocker can be randomly generated in the range of [r_{Rx} $d_{Tx\to Rx} - r_{Rx}$].
Proposal 6: The definition of LoS/Shadow region can be clarified, e.g. using figure 3, for knife edge model.
Proposal 7: The candidate of number of angularly blocked regions can be {1, 2, 3, 4}.
Proposal 8: The additional shadowing of hand-held blockage can be modelled as a fixed attenuation and frequency dependency can be considered.
Proposal 9: The existence/absence of hand-held blockage can be modelled as a discrete event.

Discussion:
Decision: The document is not treated

R1-162720 **Discussion on blockage modeling for above 6GHz channel model Samsung**

Proposal 1: The framework proposed in A8 should be used in the blockage modeling for above 6 GHz channels.
Proposal 2: The distance between the receiver and the blocking screen should be randomly generated.
Proposal 3: The average blocking period should be used in the simulation. The average blocking period is determined by Eq. (4).
Proposal 4: The blockage attenuation is constant during the blockage period. Linear transition periods of 0.01s are introduced at both sides of the blockage period.
Proposal 5: The number of blockage regions is modeled by a Poisson distributed random variable as Eq. (5).
Proposal 6: Scenario-dependent parameters listed in Table 2 need to be determined via measurements.
Proposal 7: The channel generation procedure with blockage should apply the flowchart in Figure 4.

Discussion:
Decision: The document is revised in 3393

R1-163393 **Discussion on blockage modeling for above 6GHz channel model Samsung**

Proposal 1: The framework proposed in A8 should be used in the blockage modeling for above 6 GHz channels.
Proposal 2: The distance between the receiver and the blocking screen should be randomly generated.
Proposal 3: The average blocking period should be used in the simulation. The average blocking period is determined by Eq. (4).
Proposal 4: The blockage attenuation is constant during the blockage period. Linear transition periods of 0.01s are introduced at both sides of the blockage period.
Proposal 5: The number of blockage regions is modeled by a Poisson distributed random variable as Eq. (5).
Proposal 6: Parameters of the angular blocking region in (6) can be presented by (7) and (11).
Proposal 7: Scenario-dependent parameters listed in Table 2 need to be determined via measurements.
Proposal 8: The channel generation procedure with blockage should apply the flowchart in Figure 5.

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Discussion:
Decision: The document is not treated

R1-163247 Further considerations on blockage modeling Ericsson

The following additions to the agreed WF on blocking are proposed:
Proposal A3-1: The blocking objects are modeled as screens of a fixed size randomly placed in physical locations
Proposal A4-1: Each UE should only consider the nearest K blockers (excluding self-blocking)
Proposal A5-1: The attenuation of each ray or cluster due to a certain blocker is calculated using the formula given in R1-161696
Proposal A6-1: UEs may share blockers if these are simultaneously among the K closest of both UEs
Proposal A7-1: The blocking objects may be moving
Proposal A3/7-2: Typical blocker sizes and speeds are FFS. The values given in Table 1 of R1-161623 can be considered as starting points for further discussion

Discussion:
Decision: The document is not treated

R1-163473 WF on blockage modelling Qualcomm Inc., Intel, Samsung, Nokia, Shanghai Bell, Ericsson, Interdigital

Down-select between either A or B options for proposal 3,5,6 and 7.

Discussion:

Intel: With B6 we need to consider also blocking between UEs. More considerations are needed with B6.
Ericsson: It is possible we do not disregard that with this model.
CATT: Figure below proposal 7 is not clear. Distance is related also with size of the blocker.
Ericsson: There is a difference between A and B options regarding blocking and the size of the object.

Decision: The document is agreed

8.2.3.2 Remaining details on spatial consistency modelling

Time evolution

R1-162949 Discussion on time evolution of angles Huawei, HiSilicon

Proposal 1: Adopt the model of time-variant angles given by equations (1)~(3) under the framework of spatial consistency model in [2].

Discussion:
Decision: The document is not treated

Angular consistency

R1-162244 Discussion on angular consistency model Huawei, HiSilicon

Proposal 1: The composite PASs in azimuth and zenith dimension of all clusters are generated by

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$$\phi_{n,AOA}' = \frac{2(\sigma_{ASA}/1.4)\sqrt{-\ln(P_n/\max(P_n))}}{k_c C}, \quad \theta_{n,ZOA}' = -\frac{\sigma_{ZSA}\ln(P_n/\max(P_n))}{k_c C},$$

where kc is the calibration coefficient to slow down the varying rate of angles in position.
Proposal 2: kc = 16 is a suitable value for the new model in UMi scenario.

Discussion:
Decision: The document is not treated

Spatial consistency

R1-162313 **Clarification on spatial consistency and blockage model** **CATT**

Proposal 1: The propagations should be LOS or NLOS only within a grid, and the correlation distance could have relation with ASA and AOA.
Proposal 2: The probability, position, and size of the blockers should be defined clearly.
Proposal 3: The additional shadowing of the user in LOS condition should be compared with the path loss difference between LOS and NLOS to decide the appropriate state of the user.

Discussion:
Decision: The document is not treated

R1-162389 **Remaining details on spatial consistency modelling** **Intel Corporation, InterDigital**

Proposal 1: For drop based MU-MIMO simulation, use baseline model for spatial consistency.
Proposal 2: For mobility based simulation such as beam tracking, use baseline model for initial UE dropping, followed by updating cluster delay using equation (4-1) and updating cluster angles with the limit of equation (4-2).
Proposal 3: If moving between different channel states is modelled, define soft LOS/NLOS and indoor/outdoor states and the path loss and fast fading channel are defined as a function of soft LOS/NLOS and indoor/outdoor states as in equation (5-1) and (5-2).
Proposal 4: Spatial consistency can also be calibrated as:

- *Drop UE pairs with fixed distance between the two UEs of one pair, e.g. 3 meters.*
- *Define system wide statistics between the links of two UEs to the same TRP, e.g. the serving TRP of the first dropped user in each pair.*
- *For phase-1 calibration, the difference of the LOS/NLOS state and indoor/outdoor state of each UE pair can be used as system wide statistics metrics.*
- *For phase-2 calibration, the Eigen value/or Eigen value ratio of the channel cross covariance matrix of each UE pair can be used as system wide statistics metrics.*

Discussion:

Huawei: What is the baseline model for Proposal 1? Do you assume shared clusters among users?
Intel: Working assumption and shared clusters are assumed. We have not done MU-MIMO simulations.
Huawei: That is important before agreeing proposal 1. Figure 2 leads to negative delays.
Intel: We have rounded to the minimum delay.
Huawei: What is the max moving distance? How the covariance matrix is defined?
Intel: 500 m. Matrix can be defined similarly as before, between the UEs.
ZTE: Equation 4-2. How to implement the limitation on change of angle? It is not necessary that all clusters are continuous.
Intel: Change is defined in equation. Existing stochastic model do not model this.
Ericsson: Proposal 1 assume baseline model but proposal 2 is not in line with that. It is difficult to say now how the model will be used in the future.
LGE: How can you simulate indoor / outdoor cases?
Intel: We force UE to be always outdoor.

Decision: The document is noted

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R1-162524 **Remaining details on spatial consistency modeling for channel modeling >6GHz** **LG Electronics**

Proposal 1: The working assumption should be confirmed and further discussion might be needed on how to support mobility or large array.
Proposal 2: It would be more preferable to fix the grid size to one value for large/small scale parameters and the value can be potentially the maximum correlation distance among parameters.

Discussion:
Decision: The document is not treated

R1-162721 **Discussion on spatial consistency for above 6GHz channel model** **Samsung**

Proposal 1: Alternative 1 with the proposed Step 1 to Step 5 is used in spatial consistency modeling for above 6GHz channels. Delays/AoAs/shadow fading of users in the same group are initialized according to Eq. (2) to Eq. (8).
Proposal 2: If UEs are moving in straght lines in the simulation, exponential function should be used as the filter function to generated spatially consistent random variables.

Discussion:
Decision: The document is not treated

R1-162743 **Discussion of spatial consistency modeling** **Lenovo (Beijing) Ltd**

Proposal: Generate spatially correlated random variables with the 2D filtering method.

Discussion:
Decision: The document is not treated

R1-162880 **Discussion on spatial consistency for above 6GHz** **CMCC**

Proposal: Scatters' position could be assumed based on information of the cluster power, delay and angles. The assumption of scatterers' position could faciliate the modeling of spatial consistency, for example, for UEs at difference locations (or when UE moves), the scatterer position can be used to modify angles of scatterers for different UEs (or for one UE at different positions).

Discussion:
Decision: The document is not treated

R1-162950 **Text proposal to TR 38.900 to add spatial consistency model** **Huawei, HiSilicon**

This contribution proposes some content to the 12 steps in section-2 in TR36.873.

Discussion:

Ericsson: This goes beyond of agreements so far.
Huawei: We intend to progress with common parts.
Ericsson: We prefer proposal instead of TP.
CATT: Do we need to consider handover in simulating multiple cells?
Huawei: That is not excluded.

Decision: The document is noted

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R1-162958 **Text proposal to TR 38.900 to add spatially consistent drops** **Huawei, HiSilicon**

This contribution proposes some content to the section 7 of TR38.900.

Discussion:

Ericsson: This do not necessary simplify. Better to consider consistency for all the users.
CATT: Is this in line with agreement from last meeting?
Nokia: It would be better to have spatial consistency always.
Qualcomm: We should consider also complexity.
Samsung: We need to study details further as shown in our contribution.
Sharp: How do you determine the correlation distance?

Decision: The document is noted

R1-163077 **An Alternative Interpolation Formula for Spatial Consistency** **INTERDIGITAL COMMUNICATIONS, Intel Corporation**

Proposal 1: If the interpolation of i.i.d. random variables is to be used for spatial consistency, then consider the interpolation formula in (3).

Discussion:
Decision: The document is not treated

R1-163248 **Further considerations on spatial consistency** **Ericsson**

Proposal: The revised steps 5-7 proposed in section 3 should be adopted for channel generation

Discussion:

Intel: Mathematically this looks nice but the change is significant. Few people in this session participated in the work with original steps. It is better not to change the steps. Are there measurements supporting this? Also correlation distance is impacted.
ZTE: Our view is in the middle. This provides good solution but we are confused by using uniform delay.
Ericsson: There is no measurement support but the current model has artificial behaviour. Larger the delay more paths you see.
Intel: Nobody is sure whether this is convenient approach.
Huawei: It is difficult to say the relation of angle and delay from UE side. If there is no reason to keep the order then we could also change it. We should analyse further with measurement results.
Ericsson: Other models have this kind of behaviour.

Decision: The document is noted

R1-163250 **Further details on LOS and indoor state spatial consistency modelling** **Ericsson**

Proposal 1: Introduce soft LOS states in the spatial consistency modeling
Proposal 2: Do not introduce soft indoor/outdoor states. FFS how user mobility dropping in simulations should avoid users transiting between the states
*Proposal 3: Use the knife edge-based method described in section **Error! Reference source not found.** for modeling the soft LOS states*

Discussion:
Decision: The document is not treated

R1-163467 **WF on spatial consistency** **Intel Corporation, InterDigital, Huawei, HiSilicon**

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Discussion:
Decision: The document is revised in 3475

R1-163475 WF on spatial consistency Intel Corporation, InterDigital, Huawei, HiSilicon, Qualcomm, Ericsson, LGE, Nokia, Alcatel Shanghai Bell, NTT DoCoMo, Samsung, CATT, ETRI, Lenovo, Motorola Mobility, NTT, ZTE, AT&T

Discussion:
Decision: The document is agreed

R1-163480 WF on channel temporal evolution Intel Corporation, InterDigital, Huawei, HiSilicon, Qualcomm

Discussion:

Ericsson: We support proposal for soft LOS on indoor states but we have concerns on temporal channel evolution in R1-163248.
Chair: Discuss both options further for the next meeting.

Decision: The document is noted

R1-163481 WF on generating spatial consistent random variables Lenovo, Motorola Mobility, InterDigital, Ericsson, CATT, Fujitsu

Proposal 1: Adopt the 2D filtering method to generate spatial consistent random variables.
Proposal 2: To obtain random variables within a grid area, FFS between interpolating using the generated random variables at the corners of the square grid or approximating with the random variable at the closest grid point.

Discussion:

Intel: We agree with the observation but the implementation was not captured in a TR. It was left for implementation.
Lenovo: Companies may then make errors impacting the calibration.
Huawei: This is important topic but we have also contribution R1-162956 on this. Did you consider the complexity? What is the max size of the map?
Lenovo: You can generate the area around the UE.
Intel: We could put a note in autocorrelation section referring to this.
Ericsson: TR could have informative section or annex. It would be good to have metrics for the calibration campaign.
OK for Lenovo.
Nokia: This is more like an implementation details. We don't need to define every single details.
Huawei: This is not only implementation issue. We need 2D or even higher D spatial consistent paramaters.

Decision: The document is noted

8.2.3.3 Remaining details on large antenna array modelling

R1-162314 Further discussion on large antenna array CATT

Proposal 1: The Large BW and large antenna modeling applies only when either of the following conditions holds:

(1) Antenna aperture is greater than $\frac{C}{n \cdot \Delta f_{sc} \cdot N_{FFT}}$ *meter in either azimuth or elevation.*

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(2) BW is greater than $\frac{N_{RB}N_{sc}^{RB}}{n \cdot N_{FFT}} \cdot \frac{C}{D}$ *Hz.*

Discussion:
Decision: The document is not treated

R1-162722 Discussion on large antenna modeling Samsung

Proposal 1: For >6GHz, X = 16 and for <6GHz, X = 8.
Proposal 2: Large bandwidth support applies when the bandwidth is larger than 0.1 GHz.
Proposal 3: TOAs are modeled for the strongest 3 clusters.
Proposal 4: Intra-cluster are only considered in the first 3 strongest clusters

Discussion:

Huawei: How to test phase change? What is too much? Do you assume different requirements for different frequencies?
Samsung: Few degree seems to be good criteria.
NTT DOCOMO: Larger BW will have more clusters.
Ericsson: Table 1 phase errors to be considered. Large arrays will be more common in BS side.
Qualcomm: Phase error depends on implementation.
Huawei: We should not mix antenna to the channel which is changing all the time.
LGE: Wed are preparing WF

Decision: The document is noted

R1-163245 Channel modeling considerations for supporting large antenna arrays Ericsson

Proposal 1: The amplitude distribution within a cluster is modeled with a linear decay in dB units from the cluster center in azimuth and elevation.
Proposal 2: The distribution of sub-paths is uniform in azimuth and elevation.

Discussion:
Decision: The document is not treated

R1-163474 WF on large antenna modeling LG Electronics, ETRI, InterDigital, Keysight, Samsung

Proposal 1: One of the following alternatives is agreed as condition to apply large BW and large antenna array modeling: Alt1, Alt 2, Alt 3
Proposal 2: The channel response of section 7.6.2 in R1-162714 needs to be updated as follows

Discussion:

Samsung: Alternatives 2 and 3 are not following the agreements from previous meeting. We support Alt 1.
Ericsson: We see some issues with previous agreements. Other alternatives correct those.
Nokia: Alt 1 value Y could be related to carrier frequency.
Ericsson: No. It is a relation with BW and array size. Confusion with connection between proposals 1 and 2.
CATT: Alt 2 and 3 are basically the same. Alt 1 is more comprehensive.
Huawei: There are 3 different aspects. Proposal 2 solves the one of them. We support Alt 2 to solve one problem.
Nokia: Alternatives 2 and 3 are against agreements from last meeting.
Samsung: We support Alt 1 and proposal 2.
Ericsson: We need to analyse further. We could discuss further over email.

Decision: The document is revised in 3487

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R1-163487 **WF on propagation delay modeling over large antenna array** **LG Electronics, ETRI, InterDigital, Keysight, Samsung, Ericsson, Huawei**

Discussion:

Decision: The document is agreed

8.2.3.4 Remaining details on modelling of other additional features

R1-162315 **Further discussion on atmospheric attenuation** **CATT**

Proposal 1: Subtract the impact of oxygen absorption from the measurement data before parameterizing the model
Proposal 2: Apply the frequency-dependent oxygen loss in frequency-domain channel response for the large channel bandwidth. Possible simplification can be considered to reduce the channel modeling complexity.
Proposal 3: Apply a single oxygen loss to the channel impulse response of a cluster for narrow bandwidth, e.g., <1GHz, which is a special case of Proposal 2

Discussion:

Decision: The document is agreed

R1-162955 **Discussion on stochastic reflection modeling** **Huawei, HiSilicon**

Proposal: Specular reflection term is taken into account in the channel model as an optional term.

Discussion:

Ericsson: If you add into LOS what would be the K-factor? Do we need to split the K-factor?
Huawei: Yes
Ericsson: That would be very complicated. We propose to apply only to NLOS.
Huawei: We could keep LOS as FFS.
CATT: Why the reflection is the 2nd part? Any impacts on other parameters like blocking?
LGE: Why do you use this optional term?
Huawei: It depends on the case.

Decision: The document is noted

R1-163479 **WF on UE rotational motion** **INTERDIGITAL COMMUNICATIONS, Qualcomm, Ericsson, Intel, Lenovo**

Discussion:

Fraunhofer: Antenna pattern should include time dependent angles. Then you need to change both pattern and angles. We have concerns with changing pattern.
InterDigital: Pattern itself is not changing.
ZTE: Is this always on?
InterDigital: Can be turned off.
LGE: What is the criteria to turn off?
InterDigital: Not decide yet.
Nokia: This says it is for mobility. You should consider movement together with rotation.
Qualcomm: We need to consider mobility at the same time

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Samsung: Current model is for global coordinate system. We don't need to revise the equation. We don't need to discuss when to turn on/off.
Intel: Rotation can be turned on individually without the mobility.
InterDigital: We agree can be turned on individually.

Decision: The document is noted

8.2.4 Remaining details on link-level channel models

Remaining details on beamforming modelling, scaling, etc.

Summary of email discussion

R1-162960 Summary of email discussion on link level channel model Huawei, HiSilicon

Proposal 1: The summary of email discussion described in section "2. Summary of email discussion" above is agreed as way forward.

Discussion:

Ericsson: Is this intended as WF for this meeting?
Huawei: Yes

Decision: The document is agreed

Linke level modeling

R1-162723 Discussion on LLS channel modeling Samsung

Proposal: For simplified LLS channel modelling, the normalized CDL model can be converted to TDL channel coefficient by applying Eq. (1) with brick-wall spatial filter defined by Eq. (2).

Discussion:
Decision: The document is not treated

R1-162951 Discussion on channel model for link level simulation Huawei, HiSilicon, Spirent, Keysight

Proposal: The link level channel models described in this document should be included in the channel model TR.

Discussion:
Decision: The document is not treated

R1-162959 Discussion on channel model for link level simulation in LoS scenario Huawei, HiSilicon, Spirent, Keysight, NTT DOCOMO

Proposal: The LOS link level channel models described in this document should be included in the channel model TR.

Discussion:
Decision: The document is not treated

R1-163249 Further details on link level channel models Ericsson

Proposal 1: Use angular scaling of CDLs such that a range of angular spreads can be represented by a single CDL

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Proposal 2: Use angular translation of CDLs such that a range of mean angles can be represented by a single CDL
Proposal 3: If LOS link level models are introduced, these should include scalable K-factors.

Discussion:
Decision: The document is not treated

R1-163429 Text proposal for TR 38.900 to add link level channel models including LOS Huawei, HiSilicon, CATT

Chair: Late contribution

Discussion:

Ericsson: This includes some parts of the email discussion but LOS case is not discussed and agreed.
Samsung: We have concerns on LOS table.
ZTE: Number of clusters was not agreed either for system level model. We should avoid the inconsistency between link and system level models.

Decision: The document is revised in 3476

R1-163476 Text proposal for TR 38.900 to add link level channel models Huawei, HiSilicon, CATT

Discussion:

Samsung: How to capture editorial errors in TR is up to rapporteur.
NTT DOCOMO: Comment on delay.

Decision: The document is agreed

R1-163489 WF on link level channel models for LOS Huawei, HiSilicon, Spirent, NTT DOCOMO, Vodafone

Proposal 1: Link level channel models for the LOS case are included in the TR.
Proposal 2: The LOS channel models are generated by the same method as the NLOS channel models were already generated.
Proposal 3: The LOS channel model tables in following pages are adopted as way forward.

Discussion:

Ericsson: What is the gain between LOS and NLOS cases? Our document discuss LOS channels. We have concern adding detailed model. K-factor scaling should be included.
Huawei: It is a K-factor. We try to minimize the number of variables. Existing models are based on NLOS.
Samsung: Ericsson proposal sounds good but we support this WF.
Ericsson: We can support if we include K-factor scaling.
Nokia: How to capture that in the model? We can also support if solve also K-factor issue.

Decision: The document is revised in 3491

R1-163491 WF on link level channel models for LOS Huawei, HiSilicon, Spirent, NTT DOCOMO, Vodafone, CMCC. CATT, CATR, AT&T, Ericsson

Proposal 1: Link level channel models for the LOS case are included in the TR.
Proposal 2: The LOS channel models are generated by the same method as the NLOS channel models were already generated.
Proposal 3: The LOS channel model tables in following pages are adopted as way forward.
Proposal 4: The K factor will be scalable. Example values of K factor and guidelines on how to scale the K factor will be added to the TR.

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Discussion:

Decision: The document is agreed

R1-163490 WF on spatial filtering for TDL channel models Huawei, HiSilicon, Qualcomm

Discussion:

Ericsson: There are 2 different alternatives in step. We propose to approve the 2nd one. With that we can co-source. We need to know what alpha is. What should we write to the TR.
LGE: Would it be possible to use either options or do we need to down select?
Huawei: We can have both in TR or we can also decide here.
Qualcomm: WE can leave the detail later.
Samsung: We support Ericsson suggestion step 4 scaling parameter is introduced.

Decision: The document is revised in 3643

R1-163643 WF on spatial filtering for TDL channel models Huawei, HiSilicon, Qualcomm, Samsung, Ericsson

Discussion:

Decision: The document is agreed

8.2.5 Channel modelling calibrations

8.2.5.1 Calibration scenarios and assumptions

Including UE antenna modelling

UE antenna modelling

R1-162237 UE antenna modeling for link level calibration purposes Qualcomm Inc.

Proposal 1: It is important to have a model that captures the basic aspects of subarrays and directional coverage while keeping the modeling complexity low.
Proposal 2: The antenna gain and array size should match expectations in a typical device.

Discussion:
Decision: The document is not treated

R1-162744 Discussion of antenna assumption for channel model calibration Lenovo (Beijing) Ltd, Motorola Mobility

Proposal 1: Define different antenna configurations for different frequency range.
Proposal 2: Consider defining multiple antenna configurations corresponding to different types of MS.
Proposal 3: Frequency dependent antenna radiation pattern is FFS.
Proposal 4: The full connectivity model is the baseline. Hybrid beamforming is FFS.

Discussion:

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Qualcomm: Why do we need to talk about the connectivity model?
Lenovo: How antenna elements are connected will have an impact on performance.
Huawei: We don't need to model many models. It is better to assume typical case for calibration purposes.
Nokia: We don't see a need to have multiple models.
Ericsson: Scope of this SI is channel model. Calibration will validate that implemented 12 steps are comparable. We can assume very generic antenna model.
Lenovo: We agree no detailed model is needed for the CM.

Decision: The document is noted

Scenarios

R1-162316 Further discussion on calibration scenarios CATT

Proposal 1: The 3-sector deployment can be used for indoor-office calibration scenario.
Proposal 2: the antenna pattern defined in table 7.1-1[5] and antenna modeling [4] is also applicable for indoor-office.
Proposal 3: Equation 4 can be used for calculating downtilt angle for indoor office.

Discussion:
Decision: The document is not treated

R1-162952 Discussion on channel modeling calibration scenarios Huawei, HiSilicon

Proposal 1: layouts of indoor hotspot, urban micro and urban macro scenario mentioned above should be adopted in calibration of channel model.
Proposal 2: parameters in table 1 should be adopted in calibration of channel model.

Discussion:
Decision: The document is not treated

Scenarios and assumptions

R1-162423 Further details on calibration scenarios and assumptions NTT DOCOMO, NTT

Proposal 1: Multiple carrier frequency bands can be considered for each scenario, e.g., indoor-office, UMi and UMa.
Proposal 2: Multiple eNB antenna configurations can be considered, depending on the calibration requirement. The necessity of considering multiple UE antenna configurations is FFS.
Proposal 3: If 3-sector antenna array model is used for the indoor scenario for calibration purpose, consider the antenna array placement model in Figure 1.
Proposal 4: Consider the placement of the antenna panel on the roof with the bore-sight facing the ground, and consider omni-directional antenna pattern in the azimuth and directive antenna pattern in the elevation in this case.
Proposal 5: RAN-1 shall study the beamwidth and tilting angle for the indoor antenna array placement.
Proposal 6: If random eNB antenna dropping shall be modeled, consider to reuse the model described in Section A.2 of TR 36.897.
Proposal 7: Take the simulation assumptions in Table 1 and Table 2 for channel model calibration.

Discussion:
Decision: The document is not treated

R1-162525 Discussion on calibration scenarios and assumptions LG Electronics

Proposal 1: For calibration purpose, we think that BS antenna structure with a single panel is sufficient, i.e. MgNg = 1, and adopt Table 1 for BS antenna configurations.
Proposal 2: Adopt Table 2 for UE antenna modeling.

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Discussion:
Decision: The document is not treated

R1-162724 Calibration scenarios and assumptions Samsung

Proposal 1: In phase 1, calibrate above 6GHz channel model according to Table 1
Proposal 2: In phase 2, calibrate above 6GHz channel model according to Table 2, and if needed, account for feedback from phase 1 calibration.
Proposal 3: Phase 3 calibration is FSS.

Discussion:
Decision: The document is not treated

R1-162574 Scenarios and simulation assumption for calibration Nokia, Ericsson, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung

Proposal 1: Use the scenarios, assumption and metrics from phase-1 and phase-2 calibrations in TR36.873 as starting point.
Proposal 2: Include 3D-UMa, 3D-UMi-Street Canyon, Indoor-office as the calibration scenarios
Proposal 3: Calibration assumption should consider multiple carrier frequencies, e.g. 6, 30, 70 Ghz. (further down-selection is possible)
Proposal 4: Adopt the detail calibration assumption in Section 3.
Proposal 5: Target to include the additional features in the general test metrics as much as possible.

Discussion:

Samsung: This is good starting point but we realized now that 1 and 2 GHz BWs may not need to be calibrated. We could consider 100 MHz and 200 MHz.
CATT: Is the intention to omit phase 3?
Nokia: We did not touch that. We don't need to have baseline calibration for this SI.
ZTE: If we simulate only lower BWs do you then assume only frequencies <6GHz?
Samsung: No
LGE: Do we really need to connect system BW with carrier frequency?
Nokia: Reason is to reduce the calibration cases. We can put system BWs in brackets.
Interdigital: Do you assume wrap around also in the office?
Nokia: Only for Uma and UMi.

Decision: The document is revised in 3477

R1-163477 Scenarios and simulation assumption for calibration Nokia, Ericsson, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung

Discussion:

Decision: The document is agreed

R1-163635 WF on simulation assumption for large-scale calibration Nokia, Samsung

Discussion:

Ericsson: For O2I it would make sense to have 50/50 for calibration purposes.
Samsung: We are not sure that's better.
Huawei: We agree with Ericsson. We have 2 different penetration losses. 50/50 is more reasonable.

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Nokia: How do we resolve the amount of indoor users? When we drop the users we don't need to worry about O2I.
Huawei: Penetration loss is not dependent on distribution.
NTT DOCOMO: 80% indoors was agreed last time.
Huawei: We should assume 50% high loss and 50% low loss.
ZTE: Why do we discuss this now? We could take just whatever number.
Nokia: We have also other non-realistic assumptions.
Ericson: This is one of the important issue. We should be changed to 50/50.
Samsung: We should consider the numbers again in the next meeting.
Fraunhofer: MS ant configuration says only 1 element polarized 90 degrees. What does it means.
Samsung: Ant pattern is omnidirectional.
NTT DOCOMO: We need to define the orientation of antenna panel.

Decision: The document is revised in 3641

R1-163641 WF on simulation assumption for large-scale calibration Nokia, Samsung

Discussion:

Huawei: With minimum distance of 1 m would be safer.

Agreed with clarification: minimum distance is only in 2D.

Decision: The document is agreed

R1-163638 WF on simulation assumption for full calibration Nokia, Samsung

Discussion:

Ericsson: We should add 60GHz. Which angle spreads these are?
Samsung: DoA.
LGE: UE array orientation parameters. Why don't we use the same than for 3D CM?
Samsung: WE didn't check 3D CM but OK with that.
Fraunhofer: CDF definition in 3D CM is based on eigen value of covariance matrix. Could we change it to average value instead?
Samsung: We had similar discussion in 873.
Intel: 2 angles having 60 degree difference? We could consider 0 and 0.
Samsung: No strong view on that.
Ericsson: 1st and 2nd could be better than largest and smallest.
NTT DOCOMO: 2 different ant antenna ray configurations and CSI port mapping. Does it mean 4 different configurations?
Samsung: We can do editing.
ZTE: We could ask companies to prove table. Is this full calibration for the next phase?
Samsung: This is for calibrating the channel model. We can check in the next meeting.
Nokia: Ant configuration 1 is good enough for most of the calibrations except eigen value. Is configuration 2 only for eigen value.

Decision: The document is revised in 3642

R1-163642 WF on simulation assumption for full calibration Nokia, Samsung

Discussion:

Samsung: WE propose the email discussion for the calibration campaign:
- 1 week for LS fading
- By next meeting for the full calibration

Ericsson: How do we proceed with FFS for PL model?
NTT DOCOMO: We are not sure if this kind of strict deadline for email discussion is necessary.
Samsung: Motivation is the target for finalizing things step by step.
NTT DOCOMO: Are there change to have 1st calibration round until June plenary?
Samsung: It may be possible until August.

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Huawei: Deadline should be explicit.
Samsung: 25 Apr is the deadline.
Qualcomm: What exactly are we agreeing now?
Samsung: LS fading we use the values in brackets.

Finalize details by email discussions for the next meeting. Samsung will lead the email discussion.

Decision: The document is working assumption

R1-163639 **WF on calibration of additional features** **Huawei, HiSilicon**

At least the following additional features should be included into the calibration procedure of this SI.
Spatial consistency.
Blockage

Discussion:

Samsung: Previous 2 WFs can be used also for additional features.
Ericsson: We should re-use the same table and add mobility of the users.
Huawei: There should be some new metrics to be used.
Nokia: How do we generate the change of angles? We have to model UE position changing.
Huawei: We have different approaches. Not to assume mobility or to assume mobility.
Nokia: Angle of cluster will be changing for moving user.
Huawei: Same user dropping approach can be used.
Qualcomm: It is good idea to consider few other metrics. These metrics are not clear at this point.
Intel: We agree with Qualcomm. We could have very simple extension to current approach.
Nokia: Channel autocorrelation based on user distance would be good parameter.
Ericsson: We haven't finalized these metrics yet. We could discuss over the email, for the next meeting.
Huawei: 1st bullet may be easy to agree in high level. Exact metrics depends on the final solutions.
Nokia: Do we assume angle between users or within one user?
Huawei: We can discuss details over the mail.

The 1st bullet is agreed

Decision: The document is noted

8.2.5.2 Metrics for channel model calibrations

R1-162245 **Initial results of calibration phase 1** **Huawei, HiSilicon**

Initial calibration results of phase1 for indoor hotspot, urban micro and urban macro scenarios
Proposal: take the coupling loss and geometry results into account in phase 1 of channel modelling calibration for multiple company comparison.

Discussion:
Decision: The document is not treated

R1-162317 **Discussion on calibration phases and metrics** **CATT**

Proposal 1: The channel calibration simulation for above 6GHz can be divided into three phases similar to the simulation phases in TR 36.873.
Proposal 2: The metrics in each phase in TR 36.873 can be chosen as the baseline metrics in corresponding phases in simulation for above 6GHz, the corresponding additional metric/s may be defined and added to respective phases with implementation of additional features in channel coefficient generation procedure.
Proposal 3: Simulation assumptions shown in table 1 can be used for phase 1 calibration for above 6GHz channel modeling.

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Discussion:
Decision: The document is not treated

R1-162424 Metrics on channel model calibrations NTT DOCOMO, NTT

Proposal 1: Phase-1 calibration of >6GHz channel model is based on the phase-1 calibration of the 3D channel model. Coupling loss and geometry are used for phase-1 calibration.
Proposal 2: Phase-2 calibration of >6GHz channel model is based on the phase-2 calibration of the 3D channel model. Wideband SINR and singular values are used for phase-2 calibration.
Proposal 3: Capture the metrics defined in Table 1 and Table 2 in TR for phase-1 and phase-2 calibration respectively.
Observation: Some of the additional features developed for >6GHz channel model are required by specific 5G technologies and can be calibrated during the technology study item.
Proposal 4: RAN 1 shall decide for each additional feature, whether include that feature in phase-1 and phase-2 calibration or establish a separate calibration for it.

Discussion:

Huawei: On proposal 4, it would be good to complete the calibration on all additional features.
NTT DOCOMO: Can we complete all additional features for the next meeting? What is phase 3?
Huawei: It depends on the progress. Phase 3 means additional features.

Decision: The document is noted

R1-162526 Discussion on metrics for channel modeling calibration LG Electronics

Proposal 1: The metrics in 3D channel model calibration can be reused for the calibration of the above 6GHz channel modeling.
Proposal 2: To align with a practical system, one antenna element is assumed for the coupling loss and geometry in the calibration. Also, to compare with the previous channel modeling, vertically fixed beam with N=1 can be assumed for the coupling loss and geometry in the calibration.

Discussion:
Decision: The document is not treated

R1-162725 Metrics for channel model calibrations Samsung

Discussion:
Decision: The document is withdrawn

R1-162953 Discussion on channel modeling calibration procedures Huawei, HiSilicon

Proposal 1: channel modeling calibration should verify the support for channel model requirements.
Proposal 2: channel modeling calibration should align the implementation of channel model among companies.
Proposal 3: the 4-step procedures should be considered in channel modeling calibration.
Proposal 4: the parameters and metrics in table1-4 should be considered in channel modeling calibration.

Discussion:
Decision: The document is not treated

R1-163430 WF on channel model calibration procedures Huawei, HiSilicon

Chair: Late contribution

Discussion:

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CATT: We support this WF.
Nokia: Step 4 is unnecessary. Step 3 is not needed necessary for each feature.
Samsung: Nokia proposal already propose full details.
Lenovo: Steps 4 is unnecessary at this point.

Decision: The document is noted

8.2.6 Consistent extension of the additional features to < 6GHz

No contributions

8.2.7 Map-based methodology

Summary of email discussion

R1-163117 **Email discussion on map-based hybrid model** **Keysight**

This contribution was able to report the email discussion as such without any edition work because of the relatively small number of messages sent.

Discussion:
Decision: The document is noted

Mab-based hybrid model

R1-163095 **Simulations of map-based hybrid channel model** **ZTE**

Observation 1: The proposed map-based hybrid model provides at least the following in terms of spatial consistency:

- *The realistic transition between LoS condition and NLoS condition.*
- *The smooth and close-to-real evolutions of power-delay profile, power-azimuth profile and power-zenith profile over UE's moving trajectory for the significant clusters or rays.*
- *The realistic birth-death processes for significant clusters or rays.*

Observation 2: The time consumption of the proposed map-based hybrid model is more than acceptable for the system-level simulations.

Discussion:
Decision: The document is not treated

R1-163096 **Map-based hybrid model to meet modeling requirements** **ZTE**

Observation: The map-based hybrid model fully meets all agreed modelling requirements.

Discussion:
Decision: The document is not treated

R1-163116 **Generality of map-based hybrid model** **Keysight**

This contribution has presented few simulation results to demonstrate versatility of output parameters of deterministic channel models. The simulation results show substantial statistical variation of parameters. We conclude that with a sufficient size and realistic, i.e. not too homogenous, map and a rich deployment a satisfactory generality can be reached.

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When adding more stochastic components, as is the case with the map–based hybrid model, even more diverse radio channels can be generated.

Discussion:
Decision: The document is not treated

R1-163119 Distance Dependent Cluster–Wise Angular Spread Keysight

This contribution has presented a distance dependent cluster–wise rms angular spread for the map–based hybrid model. The proposal utilizes the information of both the interaction type and the distance to/from first/last interaction points that are inherently available for deterministic clusters of the map-based hybrid model. The proposed enhancement increases the model accuracy and realism with a minimal increase of computational complexity.

Discussion:
Decision: The document is not treated

Text Proposals

R1-163094 Detailed implementation and text proposal for map-based hybrid model ZTE

Proposal: RAN1 agrees the text proposal in appendix, as an alternative methodology for high-frequency channel modeling.

Discussion:
Decision: The document is revised in 3404

R1-163102 TP for map-based hybrid model Keysight

The attached TP is to provide an update to TR 38.900. It adds the section 8 to the TR.

Discussion:
Decision: The document is not treated

R1-163404 Joint text proposal for map-based hybrid channel model ZTE, Keysight

Proposal: RAN1 agrees, in principle, the text proposal in appendix, as an alternative methodology for high-frequency channel modeling. How to finalize the sharing of certain modeling details with stochastic-only channel model is FFS.

Discussion:

Sharp: We are confused on which clusters to be removed. Are you minimizing the information loss?
ZTE: For removal of random clusters, we believe info from digital map is enough.
Ericsson: Important part is in the beginning on when to use the hybrid model. We need better guidance on which model to use and when. Consistency between results is important.
ZTE: We can revise the wording but the intention is that hybrid model is good compliment for stochastic model. If people are interested they can then use the model. E.g. agreed UMa model is based on both methods. Stochastic model is based on measurements and ray tracing.
Sharp: If results are different then how to draw the conclusion?
ZTE: That applies also to stochastic only model.
Samsung: People not participated channel model work may not know which model to use in future evaluations. We could say that bybrid model is not calibrated. It would be OK to have text as informative. This is based on inputs from 2 companies only.

Decision: The document is revised in 3478

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R1-163478 **Joint text proposal for map-based hybrid channel model ZTE, Keysight, CATR**

Discussion:

Nokia: We are fine in principle but hoe to capture should be left for rapporteur.
Ericsson: Concern having map based model. If it is validated with measurements then we are fine.
ZTE: WE have discussed this over email after AH. What parameters you like to see?
Ericsson: It says now the map based model is not calibrated. We don't know if it match with reality.
ZTE: Deterministic will be closer to realistic than stochastic model. Now we combine these models.
Ericsson: Deterministic typically worse regarding PL than stochastic.
ZTE: We gave lot of details in Malta meeting already. What else do you want to see?
Ericsson: Typical metrics for calibration.
ZTE: We can agree this as working assumption and provide results for the next meeting.
Ericsson fine but we may need to revise this based on results.

Decision: The document is working assumption

8.2.8 Other

mmMAGIC results

R1-162872 **Initial 60 GHz channel sounding results from the mmMAGIC project for corner diffraction and surface scattering Keysight**

This paper has presented results from an isolated corner diffraction measurement and surface scattering in indoor and outdoor environments of a modern building. A wideband (2 GHz) channel sounder was used at a carrier frequency of 60 GHz.
An "add-on module" needs to be developed to extend the current stochastic channel models to support spatial consistency in expected use cases. This will allow the model to accuracy represent received signal strength and multi-path variations along a route of consecutive points. The model should address the transition from LoS to NLoS (i.e. the role of corner diffraction) as well as the effects of diffuse scattering from rough and smooth building and terrain surfaces.
More measurement data is required to determine the isolated diffuse scatter process for a single interaction at mmWave frequencies, and then to determine the model for the process.

Discussion:
Decision: The document is not treated

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Annex: List of agreements at RAN1 #84bis

28 contributions agreed
1 contribution partly agreed
2 contributions as working assumption

TDoc #	Title	Source	Decision	Notes
R1-162241	LOS probability for indoor open office	Huawei, HiSilicon, AT&T, CMCC, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung	Agreed	
R1-162315	Further discussion on atmospheric attenuation	CATT	Agreed	
R1-162572	Refinement on UMa LSP	Nokia, Samsung, AT&T, CMCC, Ericsson, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm	Agreed	
R1-162576	Joint proposal on fast fading channel generations	Samsung, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm	Agreed	
R1-162710	TP for TR38.900 Section 7.1 - coordinate systems	Samsung, Nokia	Agreed	
R1-162711	TP for TR38.900 Section 7.2 and 7.3 - scenarios and antenna modeling	Samsung, Nokia	Agreed	
R1-162713	TP for TR38.900 Section 7.5 - fast fading	Samsung, Nokia	Agreed	
R1-162718	Updated joint proposal on large-scale and small-scale parameters for UMi scenario	Samsung, AT&T, CMCC, Ericsson, Huawei, HiSilicon, Intel, KT Corporation, Nokia Networks, NTT DOCOMO, Qualcomm, ETRI	Agreed	
R1-162960	Summary of email discussion on link level channel model	Huawei, HiSilicon	Agreed	
R1-163115	A hierarchical agglomerative clustering algorithm for channel modelling	Intel Corporation, Ericsson, Nokia Networks, AT&T, CMCC, ETRI, Huawei, HiSilicon, KT Corporation, NTT DOCOMO, Qualcomm, Samsung, University of Southern California	Agreed	
R1-163251	Modelling of LSPs and SSPs for the outdoor to indoor propagation	Ericsson, Nokia Networks, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung	Agreed	
R1-163255	Removing square brackets in the O2I penetration loss modeling	Ericsson, Nokia Networks, NTT DOCOMO, Samsung	Agreed	
R1-163256	Removing square brackets in the O2I penetration loss modeling, part 2	Ericsson, NTT DOCOMO, Samsung	Agreed	

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R1-163468	TP for TR38.900 Section 7.4 - pathloss, LOS, O-I modeling	Samsung, Nokia	Agreed	
R1-163469	TP for TR38.900 Section 7.6 - additional modeling components	Samsung, Nokia	Agreed	
R1-163470	TP for TR38.900 Section 7.7 and 7.8 - Link-level channel model and calibration	Samsung, Nokia	Agreed	
R1-163472	Large-scale and small-scale channel modeling for indoor hotspot	Huawei, HiSilicon, AT&T, CMCC, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung, ETRI, CATT	Agreed	
R1-163473	WF on blockage modelling	Qualcomm Inc., Intel, Samsung, Nokia, Shanghai Bell, Ericsson, Interdigital	Agreed	
R1-163475	WF on spatial consistency	Intel Corporation, InterDigital, Huawei, HiSilicon, Qualcomm, Ericsson, LGE, Nokia, Alcatel Shanghai Bell, NTT DoCoMo, Samsung, CATT, ETRI, Lenovo, Motorola Mobility, NTT, ZTE, AT&T	Agreed	
R1-163476	Text proposal for TR 38.900 to add link level channel models	Huawei, HiSilicon, CATT	Agreed	
R1-163477	Scenarios and simulation assumption for calibration	Nokia, Ericsson, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung	Agreed	
R1-163478	Joint text proposal for map-based hybrid channel model	ZTE, Keysight, CATR	Working assumption	Provide results for the next meeting
R1-163485	WF on O2I LSPs	Ericsson, Huawei, HiSilicon	Agreed	
R1-163487	WF on propagation delay modeling over large antenna array	LG Electronics, ETRI, InterDigital, Keysight, Samsung, Ericsson, Huawei	Agreed	
R1-163491	WF on link level channel models for LOS	Huawei, HiSilicon, Spirent, NTT DOCOMO, Vodafone, CMCC. CATT, CATR, AT&T, Ericsson	Agreed	
R1-163488	TP for TR38.900	Samsung, Nokia	Agreed	
R1-163637	WF on NLOS pathloss for UMa, Umi-Street Canyon and Indoor-office	Nokia, Samsung, CATT, Ericsson, NTT Docomo, Intel, Qualcomm, ZTE	Agreed	
R1-163639	WF on calibration of additional features	Huawei, HiSilicon	Noted	The 1st bullet agreed
R1-163641	WF on simulation assumption for large-scale calibration	Nokia, Samsung	Agreed	Agreed with clarification: minimum distance is only in 2D.
R1-163642	WF on simulation assumption for full calibration	Nokia, Samsung	Working assumption	Finalize details by email discussions for the next meeting.

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R1-163643	WF on spatial filtering for TDL channel models	Huawei, HiSilicon, Qualcomm, Samsung, Ericsson	Agreed	

8.3 Other

9 Closing of the meeting

Special thanks to GSMA and ETSI for hosting.
Meeting was closed at 18:30.
See you all in Nanjing.

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Annex A: List of Tdocs at RAN1 #84bis

Please see excel file attached to this report

Petitioners' Exhibit 1007, p. 1535
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Annex B: **List of CRs agreed at RAN1 #84bis**

TS	CR	Rev	Rel	Title	Cat	Vsn	TD#	Source to WG	Work Item	Clauses affected

Petitioners' Exhibit 1007, p. 1536
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Annex C-1: List of Outgoing LSs from RAN1 #84bis

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in

Petitioners' Exhibit 1007, p. 1537
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Annex C-2: List of Incoming LSs from RAN1 #84bis

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in

Petitioners' Exhibit 1007, p. 1538
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Annex D: List of Approved updated WIDs

None

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Annex E: **List of draft TSs/TRs agreed at RAN1 #84bis**

Tdoc Number	Title	Source	Conclusion/Decision

Petitioners' Exhibit 1007, p. 1540
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Annex F: List of actions

- **Outgoing LS.**

[84b-01] Johan (Ericsson)
R1-163913 [Draft] Reply LS on RAN2 review of all LTE features up to Rel-13 for Category M1 UEs Ericsson
Email approval till 20th April
Done: .

- **CR approval**

[84b-02] Editors
NB-IoT CR
Email approval till 5th May
Editors (211,212,213, 214) to provide updates including agreements and working assumptions from RAN1#84bis by April 29.
Rapporteur (Asbjorn) will provide working assumptions and agreement lists.

- **Text proposal for TS and TR**

None

- **Miscellaneous**

[84b-03] Xiaolei (HiSilicon)
Time domain resource allocation for ACK/NACK transmission for NB-IoT
Email approval until 21st April to decide between two alternatives

[84b-04] Joon (LGE)
R1-163829 WF on further details of DCI contents for multi-TTI transmission Qualcomm
R1-163830 WF on multi-TTI scheduling Mediatek
Email approval about R1-163829 and R1-163830 until 5th May

[84b-05] Havish (Ericsson)
UCI transmission for eLAA
Email approval about FFS parts and confirm WA until 5th May

[84b-06] Sorour (Ericsson)
R1-163810 WF on UL Channel Access Schemes Ericsson

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Email approval about channel access until 5th May

[84b-07] Editors
V2V CR
Editors will submit 211, 212, 213 CR skeleton until 20th May for information
Rapporteur (Hanbyul) will provide working assumptions and agreement lists.

[84b-08] Mark (Ericsson)
RMa channel model
Email approval until 28th April to revise RMa channel model

[84b-09] David Bhatoolaul (Nokia)
Scenarios and simulation assumptions for eMBMS
Email approval until 21st April

[84b-10] Hanbyul (LGE)
TP for V2X
Email approval for a TP capturing the agreements/conclusions below until 21st April

[84b-11] Wuyong (Huawei)
LLS assumptions for multiple access for NR
Email approval about LLS assumptions for multiple access until 28th April

[84b-12] Wuyong (Huawei)
SLS assumptions for multiple access for NR
Email approval about SLS assumptions for multiple access until 9th May

[84b-13] Alexei (Intel)
Evaluation assumptions for NR
Email approval about all bracket and essential FFS parts in R1-163863, transmission power assumptions above 6 GHz, UE noise figure above 6 GHz, necessity to revise the number of TRP antenna elements, over-6GHz (70GHz) to "Up to 1024 Tx /Rx antenna elements", necessity to revise the number of UE antenna elements, over-6GHz (70GHz) to "Up to 64 Tx /Rx antenna elements", and UE antenna pattern (R1-163923) until 28th April

[84b-14] Frank (Huawei)
MIMO mode and channel model parameters for NR
Email approval until 21st April

[84b-15] Joseph (Qualcomm)

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Frame structure for NR
Email discussion until 9th May about the frame structure by focusing on understanding of DL/UL/Sidelink time domain structure containing RS, the assignment, the acknowledgement, and data
(Note that this email discussion will not try to have approval)

[84b-16] Younghan (Samsung)
Large scale parameter calibration for channel model
Email discussion until 25th April for large scale parameter calibration and detailed parameters for full calibration

[84b-17] Younghan (Samsung)
Full calibration for channel model
Email discussion until the next meeting for full calibration

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Annex G: List of participants at RAN1 #84bis

Please see excel file attached to this report

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Annex H: **TSG RAN WG1 meetings in 2016 – 2017**

TITLE	TYPE	DATES	LOCATION	CTRY
3GPPRAN1#85	WG	23 – 27 May 2016	Nanjing	China
3GPPRAN1#86	WG	22 – 26 Aug 2016	Goteborg	Sweden
3GPPRAN1#86bis	WG	10 – 14 Oct 2016	Lisbon	Portugal
3GPPRAN1#87	WG	14 – 18 Nov 2016	TBD	US
3GPPRAN1#88	WG	13 – 17 Feb 2017	Athens	Greece
3GPPRAN1#88bis	WG	03 – 07 Apr 2017	TBD	US
3GPPRAN1#89	WG	15 – 19 May 2017	TBD	China
3GPPRAN1#90	WG	21 – 25 Aug 2017	Berlin (TBC)	Germany
3GPPRAN1#90bis	WG	09 – 13 Oct 2017	Prague (TBC)	Rep Czech
3GPPRAN1#91	WG	27 Nov – 01 Dec 2017	TBD	US

MEETING TYPES	
AH = Ad Hoc	CM = Chairmen's meeting
JM = Joint	OR = Ordinary
PM = Preparatory Meeting	RG = Rapporteurs Group
RM = Resolution Meeting	SG = Steering Group
ST = Startup Meeting	TG = Task Group
WG = Working Group	XO = Extraordinary

End of document

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APPENDIX 30

www.3gpp.org / ftp / tsg_ran / WG1_RL1 / TSGR1_86 / Docs

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R1-166058.zip	2016/07/28 8:26	65,6 KB
R1-166059.zip	2016/07/28 8:26	765,6 KB
R1-166060.zip	2016/07/28 16:03	281,4 KB
R1-166061.zip	2016/07/28 16:03	12,5 KB
R1-166062.zip	2016/07/28 16:03	13,4 KB
R1-166063.zip	2016/07/28 16:03	18,7 KB
R1-166064.zip	2016/07/28 16:03	59,1 KB
R1-166065.zip	2016/07/28 16:03	60,6 KB
R1-166066.zip	2016/07/28 16:03	509,6 KB
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R1-166071.zip	2016/07/28 16:03	15,7 KB
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R1-166079.zip	2016/07/28 16:03	11,5 KB
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R1-166161.zip	2016/08/12 21:22	280,7 KB
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R1-166187.zip	2016/08/12 21:23	57,7 KB
R1-166188.zip	2016/08/12 21:23	240,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-166205.zip	2016/08/12 21:24	115 KB
R1-166206.zip	2016/08/12 21:24	87,2 KB
R1-166207.zip	2016/08/12 21:24	58,5 KB
R1-166208.zip	2016/08/12 21:24	126,7 KB
R1-166209.zip	2016/08/12 21:24	63,9 KB
R1-166210.zip	2016/08/13 9:23	232,7 KB
R1-166211.zip	2016/08/13 9:21	105,8 KB
R1-166212.zip	2016/08/13 9:21	194,7 KB
R1-166213.zip	2016/08/13 9:21	142,1 KB
R1-166214.zip	2016/08/13 9:21	2112,9 KB
R1-166215.zip	2016/08/13 9:21	368,6 KB
R1-166216.zip	2016/08/13 10:33	1238,6 KB
R1-166217.zip	2016/08/13 9:21	278,7 KB
R1-166218.zip	2016/08/13 9:21	186,4 KB
R1-166219.zip	2016/08/13 9:21	97,9 KB
R1-166220.zip	2016/08/13 9:21	4474,3 KB
R1-166221.zip	2016/08/13 10:57	69,1 KB
R1-166222.zip	2016/08/13 10:57	64,1 KB

Petitioners' Exhibit 1007, p. 1551
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sort by name/desc	sort by date/desc	sort by size/desc
R1-166223.zip	2016/08/19 6:52	94,9 KB
R1-166224.zip	2016/08/19 6:52	210,4 KB
R1-166225.zip	2016/08/09 16:43	80 KB
R1-166226.zip	2016/08/09 16:43	268,1 KB
R1-166227.zip	2016/08/10 13:35	137,7 KB
R1-166228.zip	2016/08/10 0:57	252,3 KB
R1-166229.zip	2016/08/13 3:45	32,2 KB
R1-166230.zip	2016/08/13 3:45	472,7 KB
R1-166231.zip	2016/08/13 3:45	38,9 KB
R1-166232.zip	2016/08/13 3:45	32 KB
R1-166233.zip	2016/08/13 3:45	33,9 KB
R1-166234.zip	2016/08/13 3:45	27 KB
R1-166235.zip	2016/08/13 3:45	46,6 KB
R1-166236.zip	2016/08/13 3:45	26,8 KB
R1-166237.zip	2016/08/13 3:45	24 KB
R1-166238.zip	2016/08/13 3:45	19,5 KB
R1-166239.zip	2016/08/13 3:45	28,2 KB
R1-166240.zip	2016/08/13 3:45	32,5 KB
R1-166241.zip	2016/08/13 3:48	30,2 KB
R1-166242.zip	2016/08/13 3:48	32,6 KB
R1-166243.zip	2016/08/13 3:48	27,9 KB
R1-166244.zip	2016/08/13 3:48	78,2 KB
R1-166245.zip	2016/08/13 3:48	32,5 KB
R1-166246.zip	2016/08/13 3:48	23,1 KB
R1-166247.zip	2016/08/13 3:48	43,8 KB
R1-166248.zip	2016/08/13 3:48	77,8 KB
R1-166249.zip	2016/08/13 3:48	63,9 KB
R1-166250.zip	2016/08/13 3:47	30,3 KB
R1-166251.zip	2016/08/13 3:48	43,2 KB
R1-166252.zip	2016/08/13 3:48	58,3 KB
R1-166253.zip	2016/08/13 3:48	33,9 KB
R1-166254.zip	2016/08/13 3:48	30 KB
R1-166255.zip	2016/08/13 3:48	40,3 KB
R1-166256.zip	2016/08/13 3:48	559,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166257.zip	2016/08/13 3:48	60,4 KB
R1-166258.zip	2016/08/13 3:48	449 KB
R1-166259.zip	2016/08/13 3:48	57,2 KB
R1-166260.zip	2016/08/13 3:48	68,9 KB
R1-166261.zip	2016/08/13 3:50	47,8 KB
R1-166262.zip	2016/08/13 3:50	35,3 KB
R1-166263.zip	2016/08/13 3:50	23,3 KB
R1-166264.zip	2016/08/13 3:50	24,6 KB
R1-166265.zip	2016/08/13 3:50	44,1 KB
R1-166266.zip	2016/08/13 3:50	224,8 KB
R1-166267.zip	2016/08/13 3:50	23,4 KB
R1-166268.zip	2016/08/13 3:50	99,6 KB
R1-166269.zip	2016/08/13 3:50	204,8 KB
R1-166270.zip	2016/08/13 3:51	81 KB
R1-166271.zip	2016/08/13 3:52	118,3 KB
R1-166272.zip	2016/08/13 3:52	150,4 KB
R1-166273.zip	2016/08/13 3:52	55,5 KB
R1-166274.zip	2016/08/13 3:52	339 KB
R1-166275.zip	2016/08/13 3:52	46,8 KB
R1-166276.zip	2016/08/13 3:52	33,8 KB
R1-166277.zip	2016/08/13 3:52	219,2 KB
R1-166278.zip	2016/08/13 3:52	129,1 KB
R1-166279.zip	2016/08/13 3:52	54,1 KB
R1-166280.zip	2016/08/13 3:52	137,7 KB
R1-166281.zip	2016/08/13 3:53	195,8 KB
R1-166282.zip	2016/08/13 3:53	87,3 KB
R1-166283.zip	2016/08/13 3:53	119,8 KB
R1-166284.zip	2016/08/13 3:53	116,8 KB
R1-166285.zip	2016/08/13 3:53	80 KB
R1-166286.zip	2016/08/13 3:53	316,2 KB
R1-166287.zip	2016/08/13 3:53	80,4 KB
R1-166288.zip	2016/08/13 3:53	279,1 KB
R1-166289.zip	2016/08/13 3:53	77,1 KB
R1-166290.zip	2016/08/13 3:53	191,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166291.zip	2016/08/13 3:53	1382,5 KB
R1-166292.zip	2016/08/13 3:53	98,6 KB
R1-166293.zip	2016/08/13 3:53	34,5 KB
R1-166294.zip	2016/08/13 3:53	121,3 KB
R1-166296.zip	2016/08/13 3:53	77,1 KB
R1-166297.zip	2016/08/13 3:54	150 KB
R1-166298.zip	2016/08/13 3:54	75,9 KB
R1-166299.zip	2016/08/13 3:54	171,8 KB
R1-166300.zip	2016/08/13 3:54	198 KB
R1-166301.zip	2016/08/13 3:54	75,9 KB
R1-166302.zip	2016/08/13 3:54	128,7 KB
R1-166303.zip	2016/08/13 3:54	562,8 KB
R1-166304.zip	2016/08/13 3:54	34,5 KB
R1-166305.zip	2016/08/13 3:54	202,8 KB
R1-166306.zip	2016/08/13 3:54	77,7 KB
R1-166307.zip	2016/08/13 3:54	89,7 KB
R1-166308.zip	2016/08/13 3:54	95,4 KB
R1-166309.zip	2016/08/13 3:54	469,9 KB
R1-166310.zip	2016/08/13 3:54	366,6 KB
R1-166311.zip	2016/08/13 3:57	481,8 KB
R1-166312.zip	2016/08/13 3:57	481 KB
R1-166313.zip	2016/08/13 3:57	581,2 KB
R1-166314.zip	2016/08/13 3:57	400 KB
R1-166315.zip	2016/08/13 3:57	32,8 KB
R1-166317.zip	2016/08/13 3:57	62,3 KB
R1-166318.zip	2016/08/13 3:57	45,1 KB
R1-166319.zip	2016/08/13 7:57	44,4 KB
R1-166320.zip	2016/08/13 3:57	3717,5 KB
R1-166321.zip	2016/08/13 10:54	302,8 KB
R1-166322.zip	2016/08/13 9:45	414,8 KB
R1-166323.zip	2016/08/13 9:45	32,7 KB
R1-166324.zip	2016/08/13 9:45	29,6 KB
R1-166325.zip	2016/08/13 9:45	28,1 KB
R1-166326.zip	2016/08/13 9:45	81,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166327.zip	2016/08/13 9:45	41,9 KB
R1-166328.zip	2016/08/13 9:45	108,7 KB
R1-166329.zip	2016/08/13 9:45	383,7 KB
R1-166330.zip	2016/08/13 9:45	89,2 KB
R1-166331.zip	2016/08/13 9:56	43,8 KB
R1-166332.zip	2016/08/13 9:56	56,9 KB
R1-166333.zip	2016/08/13 9:56	139,2 KB
R1-166334.zip	2016/08/13 9:56	271,7 KB
R1-166335.zip	2016/08/13 9:56	145,8 KB
R1-166336.zip	2016/08/13 9:56	290,5 KB
R1-166337.zip	2016/08/12 21:50	74,1 KB
R1-166338.zip	2016/08/12 21:50	21,9 KB
R1-166339.zip	2016/08/12 21:50	676,8 KB
R1-166340.zip	2016/08/12 21:50	49,7 KB
R1-166341.zip	2016/08/12 21:50	55 KB
R1-166342.zip	2016/08/12 21:50	162,3 KB
R1-166343.zip	2016/08/12 21:50	77,6 KB
R1-166344.zip	2016/08/12 21:50	50,6 KB
R1-166345.zip	2016/08/13 10:48	33,5 KB
R1-166346.zip	2016/08/13 6:00	31,4 KB
R1-166347.zip	2016/08/13 6:00	30,3 KB
R1-166348.zip	2016/08/13 6:00	138,7 KB
R1-166350.zip	2016/08/13 6:00	114,5 KB
R1-166351.zip	2016/08/13 6:01	166,9 KB
R1-166352.zip	2016/08/13 6:01	290 KB
R1-166353.zip	2016/08/13 6:01	471,9 KB
R1-166354.zip	2016/08/13 6:01	577,7 KB
R1-166355.zip	2016/08/13 6:01	91,3 KB
R1-166356.zip	2016/08/13 6:01	105 KB
R1-166357.zip	2016/08/13 6:03	163,7 KB
R1-166358.zip	2016/08/13 6:03	546 KB
R1-166359.zip	2016/08/13 6:03	199,9 KB
R1-166360.zip	2016/08/13 6:17	281,9 KB
R1-166361.zip	2016/08/13 6:17	832,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166362.zip	2016/08/13 6:17	379,5 KB
R1-166363.zip	2016/08/13 6:17	1122,3 KB
R1-166364.zip	2016/08/13 6:17	242,8 KB
R1-166365.zip	2016/08/13 6:17	325,9 KB
R1-166367.zip	2016/08/13 6:17	146 KB
R1-166368.zip	2016/08/13 6:17	77,3 KB
R1-166369.zip	2016/08/13 6:23	197,1 KB
R1-166370.zip	2016/08/13 6:50	534,6 KB
R1-166371.zip	2016/08/13 6:23	698,5 KB
R1-166372.zip	2016/08/13 6:23	94,4 KB
R1-166373.zip	2016/08/13 6:23	197,5 KB
R1-166374.zip	2016/08/13 6:23	228,3 KB
R1-166375.zip	2016/08/13 6:23	241,5 KB
R1-166376.zip	2016/08/13 6:23	43 KB
R1-166377.zip	2016/08/13 6:05	47,5 KB
R1-166378.zip	2016/08/13 6:05	38 KB
R1-166379.zip	2016/08/13 6:05	98,2 KB
R1-166380.zip	2016/08/13 6:05	81,9 KB
R1-166381.zip	2016/08/13 6:05	105,2 KB
R1-166382.zip	2016/08/13 6:05	117,5 KB
R1-166383.zip	2016/08/13 6:05	59,4 KB
R1-166384.zip	2016/08/13 6:05	498,5 KB
R1-166385.zip	2016/08/13 6:05	29,7 KB
R1-166386.zip	2016/08/13 6:05	139,2 KB
R1-166387.zip	2016/08/13 6:05	64 KB
R1-166388.zip	2016/08/13 10:53	577,7 KB
R1-166389.zip	2016/08/13 6:07	332,6 KB
R1-166390.zip	2016/08/13 6:07	402,3 KB
R1-166391.zip	2016/08/13 6:07	356,9 KB
R1-166393.zip	2016/08/13 6:07	424,7 KB
R1-166394.zip	2016/08/13 6:07	38,1 KB
R1-166395.zip	2016/08/13 6:07	201,8 KB
R1-166396.zip	2016/08/13 6:07	40,9 KB
R1-166397.zip	2016/08/13 6:07	295,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166398.zip	2016/08/13 6:07	118,9 KB
R1-166399.zip	2016/08/13 5:17	156,9 KB
R1-166400.zip	2016/08/13 5:17	324,1 KB
R1-166401.zip	2016/08/13 5:18	510,7 KB
R1-166402.zip	2016/08/13 3:02	59,7 KB
R1-166403.zip	2016/08/13 3:02	273,4 KB
R1-166404.zip	2016/08/13 3:02	142,7 KB
R1-166405.zip	2016/08/13 3:03	205,3 KB
R1-166406.zip	2016/08/13 3:03	217,5 KB
R1-166407.zip	2016/08/13 3:04	130,3 KB
R1-166408.zip	2016/08/13 3:04	514,6 KB
R1-166409.zip	2016/08/13 3:05	147,8 KB
R1-166410.zip	2016/08/13 3:05	295,7 KB
R1-166411.zip	2016/08/13 5:18	202,8 KB
R1-166412.zip	2016/08/13 3:06	696,2 KB
R1-166413.zip	2016/08/13 3:06	110,8 KB
R1-166414.zip	2016/08/13 3:06	712,8 KB
R1-166415.zip	2016/08/13 3:07	420,7 KB
R1-166416.zip	2016/08/13 3:07	226,7 KB
R1-166417.zip	2016/08/13 3:07	257,3 KB
R1-166418.zip	2016/08/13 3:08	95,4 KB
R1-166419.zip	2016/08/13 3:08	113,1 KB
R1-166420.zip	2016/08/13 3:08	293,6 KB
R1-166421.zip	2016/08/13 3:08	47,6 KB
R1-166422.zip	2016/08/13 3:08	83,6 KB
R1-166423.zip	2016/08/13 3:09	80,2 KB
R1-166424.zip	2016/08/13 2:50	98,8 KB
R1-166425.zip	2016/08/13 2:50	77,7 KB
R1-166426.zip	2016/08/13 2:50	54,4 KB
R1-166427.zip	2016/08/13 2:51	69,5 KB
R1-166428.zip	2016/08/13 3:23	58 KB
R1-166429.zip	2016/08/13 3:23	137,1 KB
R1-166430.zip	2016/08/13 3:23	89,2 KB
R1-166431.zip	2016/08/13 3:23	95,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166432.zip	2016/08/13 3:23	793,6 KB
R1-166433.zip	2016/08/13 3:23	199,6 KB
R1-166434.zip	2016/08/13 5:48	76,1 KB
R1-166435.zip	2016/08/13 5:48	71,5 KB
R1-166436.zip	2016/08/13 3:23	279,3 KB
R1-166437.zip	2016/08/13 3:23	83,2 KB
R1-166438.zip	2016/08/13 3:23	50,2 KB
R1-166439.zip	2016/08/13 3:23	78,5 KB
R1-166440.zip	2016/08/13 3:23	104,5 KB
R1-166441.zip	2016/08/13 3:23	32,8 KB
R1-166442.zip	2016/08/13 3:23	35,7 KB
R1-166443.zip	2016/08/13 3:23	133,3 KB
R1-166444.zip	2016/08/13 3:23	43,2 KB
R1-166445.zip	2016/08/13 3:23	71,7 KB
R1-166446.zip	2016/08/13 5:56	37,1 KB
R1-166447.zip	2016/08/13 3:23	31,4 KB
R1-166448.zip	2016/08/13 3:23	145,7 KB
R1-166449.zip	2016/08/13 3:23	86,3 KB
R1-166450.zip	2016/08/13 3:23	123 KB
R1-166451.zip	2016/08/13 3:23	49,6 KB
R1-166452.zip	2016/08/13 3:23	77,9 KB
R1-166453.zip	2016/08/13 3:23	50,6 KB
R1-166454.zip	2016/08/13 3:23	23,3 KB
R1-166455.zip	2016/08/13 3:23	196,1 KB
R1-166456.zip	2016/08/13 3:23	748,9 KB
R1-166457.zip	2016/08/13 3:23	562,3 KB
R1-166458.zip	2016/08/13 3:23	50,4 KB
R1-166459.zip	2016/08/13 3:23	46,8 KB
R1-166460.zip	2016/08/13 3:23	278,2 KB
R1-166461.zip	2016/08/13 3:23	55,2 KB
R1-166462.zip	2016/08/13 3:23	76,8 KB
R1-166463.zip	2016/08/13 3:23	28,1 KB
R1-166464.zip	2016/08/13 3:23	62,8 KB
R1-166465.zip	2016/08/13 3:23	66,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166466.zip	2016/08/13 3:23	47,4 KB
R1-166467.zip	2016/08/13 3:23	32,1 KB
R1-166468.zip	2016/08/13 3:23	74,7 KB
R1-166469.zip	2016/08/13 3:23	297,2 KB
R1-166470.zip	2016/08/13 3:23	102,5 KB
R1-166471.zip	2016/08/13 3:24	79,7 KB
R1-166472.zip	2016/08/13 3:24	79,3 KB
R1-166473.zip	2016/08/13 4:23	1204 KB
R1-166474.zip	2016/08/13 4:23	302,8 KB
R1-166475.zip	2016/08/13 4:23	339,8 KB
R1-166476.zip	2016/08/13 4:23	228,8 KB
R1-166477.zip	2016/08/13 4:23	314,7 KB
R1-166478.zip	2016/08/13 3:24	35,8 KB
R1-166479.zip	2016/08/13 4:23	81,6 KB
R1-166480.zip	2016/08/13 3:24	58,4 KB
R1-166481.zip	2016/08/13 3:24	54,7 KB
R1-166482.zip	2016/08/13 3:24	265,9 KB
R1-166483.zip	2016/08/13 3:24	54,8 KB
R1-166484.zip	2016/08/13 3:24	45,2 KB
R1-166485.zip	2016/08/13 3:24	46,7 KB
R1-166486.zip	2016/08/13 3:23	84,4 KB
R1-166487.zip	2016/08/13 20:56	180,7 KB
R1-166488.zip	2016/08/13 20:56	130,5 KB
R1-166489.zip	2016/08/13 20:56	66,7 KB
R1-166490.zip	2016/08/13 3:09	140,2 KB
R1-166491.zip	2016/08/13 3:09	223 KB
R1-166492.zip	2016/08/13 3:09	122,6 KB
R1-166493.zip	2016/08/12 21:01	464,6 KB
R1-166494.zip	2016/08/12 21:02	723,2 KB
R1-166495.zip	2016/08/13 5:34	22,7 KB
R1-166496.zip	2016/08/13 5:34	22,9 KB
R1-166497.zip	2016/08/12 15:09	226,1 KB
R1-166498.zip	2016/08/13 3:58	82,6 KB
R1-166499.zip	2016/08/13 3:58	33,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166500.zip	2016/08/13 6:03	64 KB
R1-166501.zip	2016/08/13 6:03	19,8 KB
R1-166502.zip	2016/08/13 6:03	74,6 KB
R1-166503.zip	2016/08/13 6:03	55,1 KB
R1-166504.zip	2016/08/13 6:03	65,6 KB
R1-166505.zip	2016/08/13 6:03	88,8 KB
R1-166506.zip	2016/08/13 6:04	358,4 KB
R1-166507.zip	2016/08/13 6:04	356,1 KB
R1-166508.zip	2016/08/13 6:04	59,6 KB
R1-166509.zip	2016/08/13 6:03	181,5 KB
R1-166510.zip	2016/08/13 6:03	391,5 KB
R1-166511.zip	2016/08/13 6:03	74,3 KB
R1-166512.zip	2016/08/13 6:03	304,6 KB
R1-166513.zip	2016/08/13 6:04	825,6 KB
R1-166514.zip	2016/08/13 6:04	55,2 KB
R1-166515.zip	2016/08/13 6:04	637,2 KB
R1-166516.zip	2016/08/13 6:04	808,8 KB
R1-166517.zip	2016/08/13 6:04	149,8 KB
R1-166518.zip	2016/08/13 6:04	159,2 KB
R1-166519.zip	2016/08/13 6:04	63,2 KB
R1-166520.zip	2016/08/13 6:05	122 KB
R1-166521.zip	2016/08/13 6:05	166,2 KB
R1-166522.zip	2016/08/13 6:05	118,6 KB
R1-166523.zip	2016/08/13 6:05	122,4 KB
R1-166524.zip	2016/08/13 6:05	80,2 KB
R1-166525.zip	2016/08/13 6:05	218,5 KB
R1-166526.zip	2016/08/13 6:05	246,2 KB
R1-166527.zip	2016/08/13 6:05	95,5 KB
R1-166528.zip	2016/08/13 6:05	52,1 KB
R1-166529.zip	2016/08/13 6:05	52,5 KB
R1-166530.zip	2016/08/13 6:05	52,7 KB
R1-166531.zip	2016/08/13 6:05	92,6 KB
R1-166532.zip	2016/08/13 6:05	176,1 KB
R1-166533.zip	2016/08/13 6:05	134,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166534.zip	2016/08/13 6:05	155,5 KB
R1-166535.zip	2016/08/13 6:52	55,1 KB
R1-166536.zip	2016/08/13 6:52	2787,8 KB
R1-166537.zip	2016/08/13 8:05	53,4 KB
R1-166538.zip	2016/08/13 8:05	53,9 KB
R1-166539.zip	2016/08/13 8:23	53,2 KB
R1-166540.zip	2016/08/13 6:05	112,2 KB
R1-166541.zip	2016/08/13 6:05	185,7 KB
R1-166542.zip	2016/08/13 6:06	406,6 KB
R1-166543.zip	2016/08/13 6:06	206,2 KB
R1-166544.zip	2016/08/13 6:06	39,9 KB
R1-166545.zip	2016/08/13 6:06	68,8 KB
R1-166546.zip	2016/08/13 6:06	39,6 KB
R1-166547.zip	2016/08/13 6:06	172,6 KB
R1-166548.zip	2016/08/13 6:06	442 KB
R1-166549.zip	2016/08/13 6:52	3310,6 KB
R1-166550.zip	2016/08/13 6:19	178,8 KB
R1-166551.zip	2016/08/13 6:30	54,9 KB
R1-166552.zip	2016/08/13 6:30	62,9 KB
R1-166553.zip	2016/08/13 6:06	135,4 KB
R1-166554.zip	2016/08/13 6:06	52,9 KB
R1-166555.zip	2016/08/13 6:19	278,6 KB
R1-166556.zip	2016/08/13 6:19	97,6 KB
R1-166557.zip	2016/08/13 6:06	39,1 KB
R1-166558.zip	2016/08/13 6:06	28,3 KB
R1-166559.zip	2016/08/13 6:06	191 KB
R1-166560.zip	2016/08/13 6:06	472,6 KB
R1-166561.zip	2016/08/13 6:06	247,2 KB
R1-166562.zip	2016/08/13 6:06	232 KB
R1-166563.zip	2016/08/13 6:07	132,1 KB
R1-166564.zip	2016/08/13 6:07	393,9 KB
R1-166565.zip	2016/08/13 6:07	880,6 KB
R1-166566.zip	2016/08/13 6:08	180,2 KB
R1-166567.zip	2016/08/13 6:07	99,1 KB

Petitioners' Exhibit 1007, p. 1561
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sort by name/desc	sort by date/desc	sort by size/desc
R1-166568.zip	2016/08/13 6:07	389 KB
R1-166569.zip	2016/08/13 6:07	53,1 KB
R1-166570.zip	2016/08/13 6:07	141,1 KB
R1-166571.zip	2016/08/13 6:09	32,6 KB
R1-166572.zip	2016/08/13 6:09	108,3 KB
R1-166573.zip	2016/08/12 11:36	89,6 KB
R1-166574.zip	2016/08/12 11:36	1067,4 KB
R1-166575.zip	2016/08/13 20:49	249,4 KB
R1-166576.zip	2016/08/12 15:31	127,4 KB
R1-166577.zip	2016/08/12 15:31	60,7 KB
R1-166578.zip	2016/08/12 15:31	29,4 KB
R1-166579.zip	2016/08/12 15:31	45,2 KB
R1-166580.zip	2016/08/12 15:31	93,7 KB
R1-166581.zip	2016/08/13 2:39	75,2 KB
R1-166582.zip	2016/08/12 15:31	29,1 KB
R1-166583.zip	2016/08/12 15:31	101,7 KB
R1-166584.zip	2016/08/12 15:31	272,1 KB
R1-166585.zip	2016/08/12 15:31	185,3 KB
R1-166586.zip	2016/08/12 15:31	39,1 KB
R1-166587.zip	2016/08/12 20:20	46,8 KB
R1-166588.zip	2016/08/12 20:20	20,5 KB
R1-166589.zip	2016/08/12 20:20	49,4 KB
R1-166590.zip	2016/08/12 20:20	17,2 KB
R1-166591.zip	2016/08/12 20:20	30,9 KB
R1-166592.zip	2016/08/12 20:20	31,3 KB
R1-166593.zip	2016/08/12 20:20	28,9 KB
R1-166594.zip	2016/08/10 13:50	204,3 KB
R1-166595.zip	2016/08/10 13:50	186 KB
R1-166596.zip	2016/08/13 1:09	114,8 KB
R1-166599.zip	2016/08/12 4:55	1033,3 KB
R1-166600.zip	2016/08/13 3:23	152,8 KB
R1-166601.zip	2016/08/13 2:14	194,4 KB
R1-166602.zip	2016/08/12 6:46	29,4 KB
R1-166603.zip	2016/08/12 15:44	47,9 KB

Petitioners' Exhibit 1007, p. 1562
AT&T et al v. Asustek Technology & Celerity
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sort by name/desc	sort by date/desc	sort by size/desc
R1-166605.zip	2016/08/12 15:01	86,9 KB
R1-166606.zip	2016/08/12 15:01	49 KB
R1-166607.zip	2016/08/12 15:44	64,6 KB
R1-166608.zip	2016/08/12 10:41	153,7 KB
R1-166609.zip	2016/08/12 10:42	926,9 KB
R1-166610.zip	2016/08/12 10:42	71,7 KB
R1-166611.zip	2016/08/12 10:42	92,6 KB
R1-166612.zip	2016/08/12 10:42	209,5 KB
R1-166613.zip	2016/08/12 10:42	178,3 KB
R1-166614.zip	2016/08/12 10:42	43,5 KB
R1-166615.zip	2016/08/12 10:42	44,1 KB
R1-166616.zip	2016/08/12 10:42	42,8 KB
R1-166617.zip	2016/08/12 10:42	42,8 KB
R1-166618.zip	2016/08/12 10:42	44,2 KB
R1-166619.zip	2016/08/12 18:39	19,3 KB
R1-166620.zip	2016/08/12 18:39	19,5 KB
R1-166621.zip	2016/08/12 18:39	36 KB
R1-166622.zip	2016/08/12 18:39	22,9 KB
R1-166623.zip	2016/08/12 18:39	25,1 KB
R1-166624.zip	2016/08/12 18:39	58,9 KB
R1-166625.zip	2016/08/12 18:39	34,2 KB
R1-166627.zip	2016/08/12 8:20	969,6 KB
R1-166628.zip	2016/08/13 4:58	120,6 KB
R1-166629.zip	2016/08/13 4:58	348,8 KB
R1-166630.zip	2016/08/13 4:58	135,4 KB
R1-166631.zip	2016/08/12 17:20	63,4 KB
R1-166632.zip	2016/08/12 17:20	262,9 KB
R1-166633.zip	2016/08/12 17:20	343,9 KB
R1-166634.zip	2016/08/12 17:20	196,7 KB
R1-166635.zip	2016/08/12 17:20	96,5 KB
R1-166636.zip	2016/08/12 17:20	62,3 KB
R1-166637.zip	2016/08/12 17:20	46,9 KB
R1-166638.zip	2016/08/12 17:20	66,8 KB
R1-166639.zip	2016/08/12 17:20	68,4 KB

Petitioners' Exhibit 1007, p. 1563
AT&T et al v. Asustek Technology & Celerity
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sort by name/desc	sort by date/desc	sort by size/desc
R1-166640.zip	2016/08/12 17:20	39 KB
R1-166641.zip	2016/08/12 17:20	114,8 KB
R1-166642.zip	2016/08/12 17:20	59,8 KB
R1-166643.zip	2016/08/12 17:20	87,2 KB
R1-166644.zip	2016/08/12 17:20	532,7 KB
R1-166645.zip	2016/08/12 17:20	49 KB
R1-166646.zip	2016/08/12 17:20	28,6 KB
R1-166647.zip	2016/08/12 17:20	46,9 KB
R1-166648.zip	2016/08/12 17:20	30,8 KB
R1-166649.zip	2016/08/12 18:00	230,6 KB
R1-166650.zip	2016/08/12 18:00	706,3 KB
R1-166651.zip	2016/08/12 18:00	494,9 KB
R1-166652.zip	2016/08/12 18:00	142,5 KB
R1-166653.zip	2016/08/12 18:00	60,1 KB
R1-166654.zip	2016/08/12 18:00	54 KB
R1-166655.zip	2016/08/12 18:00	34,3 KB
R1-166656.zip	2016/08/12 18:00	360,7 KB
R1-166657.zip	2016/08/12 18:00	460 KB
R1-166658.zip	2016/08/12 18:00	43,9 KB
R1-166659.zip	2016/08/12 18:00	36,6 KB
R1-166660.zip	2016/08/12 18:00	95,8 KB
R1-166661.zip	2016/08/12 18:00	21 KB
R1-166662.zip	2016/08/12 18:00	53,4 KB
R1-166663.zip	2016/08/12 18:00	13,7 KB
R1-166664.zip	2016/08/12 18:00	86 KB
R1-166665.zip	2016/08/13 4:01	34 KB
R1-166666.zip	2016/08/31 16:28	38,9 KB
R1-166667.zip	2016/08/12 15:53	124,2 KB
R1-166669.zip	2016/08/12 15:53	210,3 KB
R1-166670.zip	2016/08/12 15:53	735,5 KB
R1-166671.zip	2016/08/12 15:54	686,2 KB
R1-166672.zip	2016/08/12 15:54	555,8 KB
R1-166673.zip	2016/08/12 15:55	87 KB
R1-166674.zip	2016/08/12 15:54	353,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166675.zip	2016/08/12 15:54	391,8 KB
R1-166676.zip	2016/08/12 15:54	109,9 KB
R1-166677.zip	2016/08/12 15:54	364,4 KB
R1-166678.zip	2016/08/12 15:54	277,9 KB
R1-166679.zip	2016/08/12 23:30	99,1 KB
R1-166680.zip	2016/08/13 0:06	67,1 KB
R1-166681.zip	2016/08/12 23:30	45,1 KB
R1-166682.zip	2016/08/12 23:30	41,6 KB
R1-166683.zip	2016/08/12 22:32	37,6 KB
R1-166684.zip	2016/08/12 22:32	189,4 KB
R1-166685.zip	2016/08/13 0:35	60,4 KB
R1-166686.zip	2016/08/12 22:32	50,5 KB
R1-166687.zip	2016/08/13 3:40	238,1 KB
R1-166688.zip	2016/08/13 0:35	51,3 KB
R1-166689.zip	2016/08/13 3:40	52,9 KB
R1-166690.zip	2016/08/13 3:40	140,1 KB
R1-166691.zip	2016/08/13 3:40	57,6 KB
R1-166692.zip	2016/08/13 0:35	54 KB
R1-166693.zip	2016/08/13 0:35	55,1 KB
R1-166694.zip	2016/08/13 0:35	50,2 KB
R1-166695.zip	2016/08/13 0:35	109,7 KB
R1-166696.zip	2016/08/13 0:35	60,3 KB
R1-166697.zip	2016/08/13 0:35	64,9 KB
R1-166698.zip	2016/08/13 0:35	70,5 KB
R1-166699.zip	2016/08/13 0:35	79,3 KB
R1-166700.zip	2016/08/13 0:36	65,4 KB
R1-166701.zip	2016/08/13 0:36	338,3 KB
R1-166702.zip	2016/08/13 0:36	145,7 KB
R1-166703.zip	2016/08/13 0:36	87 KB
R1-166704.zip	2016/08/13 0:36	47,8 KB
R1-166705.zip	2016/08/13 0:36	95,3 KB
R1-166706.zip	2016/08/13 0:36	48,4 KB
R1-166707.zip	2016/08/13 0:36	93,5 KB
R1-166708.zip	2016/08/13 0:36	124,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166709.zip	2016/08/12 23:05	30,6 KB
R1-166710.zip	2016/08/12 19:21	88,1 KB
R1-166712.zip	2016/08/12 23:05	279,4 KB
R1-166713.zip	2016/08/13 3:40	58,1 KB
R1-166714.zip	2016/08/13 3:40	110,5 KB
R1-166715.zip	2016/08/13 3:40	348,8 KB
R1-166716.zip	2016/08/13 3:41	257,2 KB
R1-166717.zip	2016/08/13 3:41	700,1 KB
R1-166718.zip	2016/08/13 3:41	135,1 KB
R1-166719.zip	2016/08/13 3:41	92,7 KB
R1-166720.zip	2016/08/13 3:41	516,7 KB
R1-166721.zip	2016/08/13 3:41	434,2 KB
R1-166723.zip	2016/08/13 4:35	324,7 KB
R1-166724.zip	2016/08/12 22:16	50 KB
R1-166725.zip	2016/08/12 6:33	359,5 KB
R1-166726.zip	2016/08/12 6:33	75,4 KB
R1-166727.zip	2016/08/28 14:14	155,8 KB
R1-166728.zip	2016/08/12 22:16	82,8 KB
R1-166729.zip	2016/08/12 21:26	1870,1 KB
R1-166730.zip	2016/08/12 21:26	152,6 KB
R1-166731.zip	2016/08/12 22:16	388,1 KB
R1-166732.zip	2016/08/12 6:33	53,7 KB
R1-166733.zip	2016/08/12 6:33	134,4 KB
R1-166734.zip	2016/08/12 21:26	475,6 KB
R1-166735.zip	2016/08/12 21:26	294,5 KB
R1-166736.zip	2016/08/12 22:16	251,1 KB
R1-166737.zip	2016/08/12 6:33	47,6 KB
R1-166738.zip	2016/08/12 21:26	238,3 KB
R1-166739.zip	2016/08/12 22:32	60 KB
R1-166740.zip	2016/08/12 22:32	47,3 KB
R1-166741.zip	2016/08/12 22:32	48,5 KB
R1-166742.zip	2016/08/12 19:20	69,6 KB
R1-166743.zip	2016/08/12 6:51	70,9 KB
R1-166744.zip	2016/08/12 6:51	92,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166745.zip	2016/08/12 11:40	62,3 KB
R1-166746.zip	2016/08/12 13:35	441,1 KB
R1-166747.zip	2016/08/12 13:36	857,8 KB
R1-166748.zip	2016/08/12 13:36	1145,6 KB
R1-166749.zip	2016/08/12 13:36	530,8 KB
R1-166750.zip	2016/08/12 9:43	139,7 KB
R1-166751.zip	2016/08/12 9:43	61,6 KB
R1-166752.zip	2016/08/12 9:43	59,3 KB
R1-166753.zip	2016/08/12 6:51	274,1 KB
R1-166754.zip	2016/08/12 6:51	174,2 KB
R1-166755.zip	2016/08/12 9:27	22,8 KB
R1-166756.zip	2016/08/12 6:51	100,9 KB
R1-166757.zip	2016/08/12 6:51	116,3 KB
R1-166758.zip	2016/08/12 6:51	70,5 KB
R1-166759.zip	2016/08/13 0:36	72,1 KB
R1-166760.zip	2016/08/12 6:52	674,1 KB
R1-166761.zip	2016/08/12 22:32	52,8 KB
R1-166762.zip	2016/08/12 22:32	50,6 KB
R1-166763.zip	2016/08/12 21:35	53,9 KB
R1-166764.zip	2016/08/12 21:35	40,4 KB
R1-166765.zip	2016/08/12 9:29	23 KB
R1-166766.zip	2016/08/12 8:44	29,1 KB
R1-166767.zip	2016/08/12 9:52	343,1 KB
R1-166768.zip	2016/08/13 5:53	604,7 KB
R1-166769.zip	2016/08/13 5:33	290,2 KB
R1-166770.zip	2016/08/13 5:33	329 KB
R1-166771.zip	2016/08/13 5:33	1266,1 KB
R1-166772.zip	2016/08/13 5:24	1582,4 KB
R1-166773.zip	2016/08/13 5:24	79,2 KB
R1-166774.zip	2016/08/13 5:33	372,4 KB
R1-166775.zip	2016/08/13 5:24	385,1 KB
R1-166776.zip	2016/08/12 13:06	164,3 KB
R1-166777.zip	2016/08/12 13:06	280 KB
R1-166778.zip	2016/08/12 6:33	206,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166779.zip	2016/08/12 6:33	219 KB
R1-166780.zip	2016/08/12 6:33	124,6 KB
R1-166781.zip	2016/08/12 22:16	528,3 KB
R1-166782.zip	2016/08/12 22:16	439,2 KB
R1-166783.zip	2016/08/12 21:26	162,7 KB
R1-166784.zip	2016/08/12 21:26	123,2 KB
R1-166785.zip	2016/08/12 23:05	739,6 KB
R1-166786.zip	2016/08/12 23:05	104,2 KB
R1-166787.zip	2016/08/12 19:20	34,9 KB
R1-166788.zip	2016/08/12 19:20	35 KB
R1-166789.zip	2016/08/12 19:20	277,9 KB
R1-166790.zip	2016/08/12 9:28	642 KB
R1-166791.zip	2016/08/12 12:40	171,7 KB
R1-166792.zip	2016/08/12 12:40	180,9 KB
R1-166793.zip	2016/08/12 6:33	37,6 KB
R1-166794.zip	2016/08/12 6:52	178,3 KB
R1-166795.zip	2016/08/12 6:52	125,1 KB
R1-166796.zip	2016/08/12 22:16	99,1 KB
R1-166797.zip	2016/08/12 10:13	255,7 KB
R1-166798.zip	2016/08/12 10:13	75,3 KB
R1-166799.zip	2016/08/12 9:29	41,7 KB
R1-166800.zip	2016/08/13 0:36	63,7 KB
R1-166801.zip	2016/08/12 23:05	615,3 KB
R1-166802.zip	2016/08/12 23:05	637,6 KB
R1-166803.zip	2016/08/12 13:31	45,1 KB
R1-166804.zip	2016/08/12 6:52	53,6 KB
R1-166805.zip	2016/08/12 6:52	54,9 KB
R1-166806.zip	2016/08/12 22:32	62,7 KB
R1-166807.zip	2016/08/12 21:35	146,4 KB
R1-166808.zip	2016/08/12 12:38	22,8 KB
R1-166809.zip	2016/08/12 12:38	28,3 KB
R1-166810.zip	2016/08/12 12:38	21,4 KB
R1-166811.zip	2016/08/12 12:38	26,5 KB
R1-166812.zip	2016/08/13 4:43	57,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166813.zip	2016/08/13 4:43	48,2 KB
R1-166814.zip	2016/08/13 4:43	38,8 KB
R1-166815.zip	2016/08/13 4:43	46,3 KB
R1-166816.zip	2016/08/13 4:43	64,5 KB
R1-166817.zip	2016/08/13 4:43	77,5 KB
R1-166818.zip	2016/08/13 4:44	41,8 KB
R1-166819.zip	2016/08/13 4:44	60,8 KB
R1-166820.zip	2016/08/13 4:44	33,9 KB
R1-166821.zip	2016/08/13 4:44	53,9 KB
R1-166822.zip	2016/08/13 4:44	51,5 KB
R1-166823.zip	2016/08/13 4:44	39 KB
R1-166825.zip	2016/08/13 4:44	67,7 KB
R1-166826.zip	2016/08/13 4:44	67,2 KB
R1-166827.zip	2016/08/13 4:44	59,9 KB
R1-166828.zip	2016/08/13 4:44	61,7 KB
R1-166829.zip	2016/08/13 4:44	91,2 KB
R1-166830.zip	2016/08/13 4:44	75,8 KB
R1-166831.zip	2016/08/13 4:44	62,6 KB
R1-166832.zip	2016/08/13 4:44	69,6 KB
R1-166833.zip	2016/08/13 4:44	74 KB
R1-166834.zip	2016/08/13 4:44	60 KB
R1-166835.zip	2016/08/13 4:44	40 KB
R1-166836.zip	2016/08/13 4:44	57 KB
R1-166837.zip	2016/08/13 4:44	81,4 KB
R1-166838.zip	2016/08/13 4:44	156,9 KB
R1-166839.zip	2016/08/13 4:44	38,8 KB
R1-166840.zip	2016/08/13 4:44	89,6 KB
R1-166841.zip	2016/08/13 4:47	37 KB
R1-166842.zip	2016/08/13 4:47	31,7 KB
R1-166843.zip	2016/08/13 4:47	94,1 KB
R1-166844.zip	2016/08/13 4:47	143,2 KB
R1-166845.zip	2016/08/13 4:47	228 KB
R1-166846.zip	2016/08/13 4:47	76,9 KB
R1-166847.zip	2016/08/13 4:49	65,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-166848.zip	2016/08/13 4:47	78,3 KB
R1-166849.zip	2016/08/13 4:49	183,5 KB
R1-166850.zip	2016/08/13 4:47	36,7 KB
R1-166851.zip	2016/08/13 4:47	58,8 KB
R1-166852.zip	2016/08/13 4:47	97 KB
R1-166853.zip	2016/08/13 4:48	47,8 KB
R1-166854.zip	2016/08/13 4:48	34,7 KB
R1-166855.zip	2016/08/13 4:48	37,7 KB
R1-166856.zip	2016/08/13 4:53	68,9 KB
R1-166857.zip	2016/08/13 4:48	36,6 KB
R1-166858.zip	2016/08/13 4:48	72 KB
R1-166859.zip	2016/08/13 4:48	57,7 KB
R1-166860.zip	2016/08/13 4:48	381,2 KB
R1-166861.zip	2016/08/13 4:48	164,2 KB
R1-166862.zip	2016/08/13 4:48	57,7 KB
R1-166863.zip	2016/08/13 4:48	36,8 KB
R1-166864.zip	2016/08/13 4:53	90,8 KB
R1-166865.zip	2016/08/13 4:48	39,6 KB
R1-166866.zip	2016/08/13 4:48	47,2 KB
R1-166867.zip	2016/08/13 4:38	46,7 KB
R1-166868.zip	2016/08/13 4:38	89,4 KB
R1-166869.zip	2016/08/13 4:39	573,4 KB
R1-166870.zip	2016/08/13 4:39	595,8 KB
R1-166871.zip	2016/08/13 4:39	63,3 KB
R1-166872.zip	2016/08/13 4:39	42,2 KB
R1-166873.zip	2016/08/13 7:37	30,8 KB
R1-166874.zip	2016/08/13 4:39	148,3 KB
R1-166875.zip	2016/08/13 4:39	33,5 KB
R1-166876.zip	2016/08/13 4:39	110 KB
R1-166877.zip	2016/08/13 4:39	38,8 KB
R1-166878.zip	2016/08/13 4:39	83,5 KB
R1-166879.zip	2016/08/13 4:39	155,6 KB
R1-166880.zip	2016/08/13 4:39	51,3 KB
R1-166881.zip	2016/08/13 4:40	179,5 KB

Petitioners' Exhibit 1007, p. 1570
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-166882.zip	2016/08/13 4:40	38,9 KB
R1-166883.zip	2016/08/13 4:52	263,7 KB
R1-166884.zip	2016/08/13 4:52	40,1 KB
R1-166885.zip	2016/08/13 4:40	95,1 KB
R1-166886.zip	2016/08/13 4:40	60,3 KB
R1-166887.zip	2016/08/13 4:40	45,8 KB
R1-166888.zip	2016/08/13 4:40	41,5 KB
R1-166889.zip	2016/08/13 4:40	71,1 KB
R1-166890.zip	2016/08/13 4:40	155 KB
R1-166891.zip	2016/08/13 4:40	898,4 KB
R1-166892.zip	2016/08/13 4:40	194,2 KB
R1-166893.zip	2016/08/17 15:11	141,6 KB
R1-166894.zip	2016/08/13 4:40	250,8 KB
R1-166895.zip	2016/08/13 4:40	33,7 KB
R1-166896.zip	2016/08/13 4:40	519,8 KB
R1-166897.zip	2016/08/13 4:40	131,5 KB
R1-166898.zip	2016/08/13 4:40	152,1 KB
R1-166899.zip	2016/08/13 4:40	107,4 KB
R1-166900.zip	2016/08/13 4:40	124,2 KB
R1-166901.zip	2016/08/13 4:41	41,8 KB
R1-166902.zip	2016/08/13 4:41	59,1 KB
R1-166903.zip	2016/08/13 4:41	308,5 KB
R1-166904.zip	2016/08/13 4:42	200,3 KB
R1-166905.zip	2016/08/13 4:42	73,7 KB
R1-166906.zip	2016/08/13 4:42	58,2 KB
R1-166907.zip	2016/08/13 4:42	199,4 KB
R1-166908.zip	2016/08/13 4:42	286,8 KB
R1-166909.zip	2016/08/13 4:42	163,3 KB
R1-166910.zip	2016/08/13 4:42	132,2 KB
R1-166911.zip	2016/08/13 4:42	193,4 KB
R1-166912.zip	2016/08/13 4:42	809,7 KB
R1-166913.zip	2016/08/13 4:42	61,8 KB
R1-166914.zip	2016/08/13 4:42	40,1 KB
R1-166915.zip	2016/08/13 4:42	97,5 KB

Petitioners' Exhibit 1007, p. 1571
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-166916.zip	2016/08/13 4:42	77,5 KB
R1-166917.zip	2016/08/13 4:42	75 KB
R1-166918.zip	2016/08/13 4:42	41,7 KB
R1-166919.zip	2016/08/13 4:42	37,8 KB
R1-166920.zip	2016/08/13 4:42	38,6 KB
R1-166921.zip	2016/08/13 4:42	106,2 KB
R1-166922.zip	2016/08/13 4:42	36,4 KB
R1-166923.zip	2016/08/13 4:42	128,3 KB
R1-166924.zip	2016/08/13 4:42	187,3 KB
R1-166925.zip	2016/08/13 4:42	34,9 KB
R1-166926.zip	2016/08/13 6:23	787,5 KB
R1-166927.zip	2016/08/13 6:23	101,8 KB
R1-166928.zip	2016/08/13 6:23	233,2 KB
R1-166929.zip	2016/08/13 6:23	760,8 KB
R1-166930.zip	2016/08/13 6:24	286,2 KB
R1-166931.zip	2016/08/13 6:24	364,4 KB
R1-166932.zip	2016/08/13 6:24	41,1 KB
R1-166933.zip	2016/08/13 6:29	46,1 KB
R1-166934.zip	2016/08/13 6:24	41 KB
R1-166935.zip	2016/08/13 8:16	35,9 KB
R1-166936.zip	2016/08/13 6:23	819,7 KB
R1-166937.zip	2016/08/12 11:35	720,3 KB
R1-166938.zip	2016/08/12 11:35	506,7 KB
R1-166939.zip	2016/08/13 4:13	238,5 KB
R1-166940.zip	2016/08/13 4:15	99,9 KB
R1-166941.zip	2016/08/13 4:15	223,7 KB
R1-166942.zip	2016/08/13 4:37	27 KB
R1-166943.zip	2016/08/13 4:15	91,3 KB
R1-166944.zip	2016/08/13 4:15	131,8 KB
R1-166945.zip	2016/08/13 4:16	30,4 KB
R1-166946.zip	2016/08/13 4:16	29 KB
R1-166947.zip	2016/08/13 4:15	491,7 KB
R1-166948.zip	2016/08/13 4:15	219,8 KB
R1-166949.zip	2016/08/13 4:15	159,8 KB

Petitioners' Exhibit 1007, p. 1572
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sort by name/desc	sort by date/desc	sort by size/desc
R1-166951.zip	2016/08/12 14:56	125,1 KB
R1-166952.zip	2016/08/13 2:31	401,5 KB
R1-166953.zip	2016/08/12 14:56	82,4 KB
R1-166954.zip	2016/08/13 2:30	43,1 KB
R1-166955.zip	2016/08/12 14:56	91,5 KB
R1-166956.zip	2016/08/12 14:56	67 KB
R1-166957.zip	2016/08/12 14:56	74,2 KB
R1-166958.zip	2016/08/13 1:05	58,2 KB
R1-166959.zip	2016/08/12 14:56	72,5 KB
R1-166960.zip	2016/08/12 14:56	123,5 KB
R1-166961.zip	2016/08/12 14:56	74,8 KB
R1-166962.zip	2016/08/12 14:56	60,8 KB
R1-166963.zip	2016/08/12 14:56	124,3 KB
R1-166964.zip	2016/08/12 14:56	102,8 KB
R1-166965.zip	2016/08/12 14:56	115,7 KB
R1-166966.zip	2016/08/12 10:34	102,8 KB
R1-166967.zip	2016/08/12 10:34	122,4 KB
R1-166968.zip	2016/08/12 10:34	67,1 KB
R1-166969.zip	2016/08/12 10:34	73,8 KB
R1-166970.zip	2016/08/12 10:34	73,6 KB
R1-166971.zip	2016/08/12 10:34	84,2 KB
R1-166972.zip	2016/08/12 10:34	118,1 KB
R1-166973.zip	2016/08/12 10:34	90,4 KB
R1-166974.zip	2016/08/12 14:56	136,3 KB
R1-166975.zip	2016/08/12 14:56	73,4 KB
R1-166976.zip	2016/08/12 16:08	40,1 KB
R1-166977.zip	2016/08/12 16:08	27,5 KB
R1-166978.zip	2016/08/12 16:08	31,9 KB
R1-166979.zip	2016/08/12 16:08	30,9 KB
R1-166980.zip	2016/08/12 16:08	123,9 KB
R1-166981.zip	2016/08/12 16:08	38,3 KB
R1-166982.zip	2016/08/12 16:08	71,8 KB
R1-166983.zip	2016/08/12 16:08	46,9 KB
R1-166984.zip	2016/08/12 16:08	175,8 KB

Petitioners' Exhibit 1007, p. 1573
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sort by name/desc	sort by date/desc	sort by size/desc
R1-166985.zip	2016/08/12 16:26	102,4 KB
R1-166986.zip	2016/08/12 16:26	88,5 KB
R1-166987.zip	2016/08/12 17:44	86 KB
R1-166988.zip	2016/08/12 17:44	45 KB
R1-166989.zip	2016/08/12 17:44	46 KB
R1-166993.zip	2016/08/12 13:53	81,2 KB
R1-166995.zip	2016/08/12 13:53	49,2 KB
R1-166996.zip	2016/08/12 13:53	90,2 KB
R1-166997.zip	2016/08/12 13:53	283,4 KB
R1-166998.zip	2016/08/12 13:53	89,8 KB
R1-166999.zip	2016/08/12 13:53	150 KB
R1-167000.zip	2016/08/12 13:53	140,3 KB
R1-167001.zip	2016/08/12 13:53	480,3 KB
R1-167002.zip	2016/08/12 13:53	234,6 KB
R1-167004.zip	2016/08/12 13:53	65 KB
R1-167005.zip	2016/08/12 13:53	119,1 KB
R1-167006.zip	2016/08/12 13:53	232,3 KB
R1-167007.zip	2016/08/12 14:56	75,3 KB
R1-167008.zip	2016/08/15 14:50	130,5 KB
R1-167009.zip	2016/08/12 14:56	223,1 KB
R1-167010.zip	2016/08/12 14:56	224 KB
R1-167011.zip	2016/08/12 14:56	74,9 KB
R1-167012.zip	2016/08/12 14:56	77,8 KB
R1-167013.zip	2016/08/12 14:56	119,4 KB
R1-167014.zip	2016/08/12 14:56	98,5 KB
R1-167015.zip	2016/08/12 14:56	72,3 KB
R1-167016.zip	2016/08/12 15:02	27,9 KB
R1-167017.zip	2016/08/12 15:02	40,5 KB
R1-167018.zip	2016/08/12 14:59	251,2 KB
R1-167019.zip	2016/08/12 15:02	96,5 KB
R1-167021.zip	2016/08/12 15:02	256,5 KB
R1-167022.zip	2016/08/12 15:02	38,6 KB
R1-167023.zip	2016/08/12 15:02	20 KB
R1-167024.zip	2016/08/12 15:02	59,9 KB

Petitioners' Exhibit 1007, p. 1574
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sort by name/desc	sort by date/desc	sort by size/desc
R1-167026.zip	2016/08/12 15:02	29,9 KB
R1-167027.zip	2016/08/12 11:57	24,2 KB
R1-167028.zip	2016/08/12 11:57	30,7 KB
R1-167029.zip	2016/08/12 20:10	45,8 KB
R1-167030.zip	2016/08/12 19:40	158,9 KB
R1-167031.zip	2016/08/12 19:40	102,9 KB
R1-167032.zip	2016/08/12 19:40	103,4 KB
R1-167033.zip	2016/08/12 19:40	91,6 KB
R1-167034.zip	2016/08/12 19:40	61,3 KB
R1-167035.zip	2016/08/12 19:40	57,1 KB
R1-167036.zip	2016/08/12 19:40	79,6 KB
R1-167037.zip	2016/08/12 20:11	92,2 KB
R1-167038.zip	2016/08/12 20:11	39,9 KB
R1-167039.zip	2016/08/12 12:59	40,2 KB
R1-167040.zip	2016/08/12 12:59	24,4 KB
R1-167041.zip	2016/08/12 19:40	26,4 KB
R1-167042.zip	2016/08/12 12:59	45,2 KB
R1-167043.zip	2016/08/12 12:59	38 KB
R1-167044.zip	2016/08/12 12:59	34,3 KB
R1-167045.zip	2016/08/12 12:59	36,9 KB
R1-167046.zip	2016/08/12 12:59	84,2 KB
R1-167047.zip	2016/08/12 12:59	50,8 KB
R1-167048.zip	2016/08/12 12:59	41,5 KB
R1-167049.zip	2016/08/12 12:59	41,2 KB
R1-167050.zip	2016/08/12 12:59	117,2 KB
R1-167051.zip	2016/08/12 12:59	26,9 KB
R1-167052.zip	2016/08/12 12:59	76,6 KB
R1-167053.zip	2016/08/12 12:59	34,3 KB
R1-167054.zip	2016/08/12 12:59	20,9 KB
R1-167055.zip	2016/08/12 20:11	31,2 KB
R1-167056.zip	2016/08/13 20:42	19,7 KB
R1-167057.zip	2016/08/13 20:42	19,9 KB
R1-167058.zip	2016/08/12 20:11	559,3 KB
R1-167059.zip	2016/08/12 20:11	850 KB

Petitioners' Exhibit 1007, p. 1575
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-167060.zip	2016/08/12 20:11	342,4 KB
R1-167061.zip	2016/08/12 19:40	101,4 KB
R1-167062.zip	2016/08/12 19:40	48,4 KB
R1-167063.zip	2016/08/12 19:40	74,6 KB
R1-167064.zip	2016/08/12 19:40	76,7 KB
R1-167065.zip	2016/08/12 19:40	75,4 KB
R1-167066.zip	2016/08/12 19:40	74,5 KB
R1-167067.zip	2016/08/12 12:59	76,5 KB
R1-167068.zip	2016/08/12 19:40	15,9 KB
R1-167069.zip	2016/08/12 16:01	16,4 KB
R1-167070.zip	2016/08/12 16:01	27 KB
R1-167071.zip	2016/08/12 16:01	72,1 KB
R1-167072.zip	2016/08/12 16:01	21,3 KB
R1-167073.zip	2016/08/12 16:01	19,9 KB
R1-167074.zip	2016/08/12 16:01	78,3 KB
R1-167075.zip	2016/08/12 16:01	14,6 KB
R1-167076.zip	2016/08/12 18:00	174,7 KB
R1-167077.zip	2016/08/12 18:00	86,9 KB
R1-167078.zip	2016/08/12 18:00	570,2 KB
R1-167079.zip	2016/08/12 19:40	89,5 KB
R1-167080.zip	2016/08/12 19:40	87,9 KB
R1-167081.zip	2016/08/12 15:49	36 KB
R1-167082.zip	2016/08/12 15:49	250 KB
R1-167083.zip	2016/08/12 15:49	210,8 KB
R1-167084.zip	2016/08/12 15:49	55,4 KB
R1-167085.zip	2016/08/12 15:49	520,4 KB
R1-167086.zip	2016/08/11 11:50	316,8 KB
R1-167087.zip	2016/08/12 21:50	43,5 KB
R1-167088.zip	2016/08/12 13:32	174,9 KB
R1-167089.zip	2016/08/12 18:01	102,8 KB
R1-167090.zip	2016/08/12 10:53	1590,1 KB
R1-167091.zip	2016/08/13 2:02	120,9 KB
R1-167092.zip	2016/08/13 2:02	199,9 KB
R1-167093.zip	2016/08/13 2:02	145,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167094.zip	2016/08/13 2:02	52,1 KB
R1-167095.zip	2016/08/13 2:02	180,8 KB
R1-167096.zip	2016/08/13 2:02	54,4 KB
R1-167097.zip	2016/08/13 2:02	415,3 KB
R1-167098.zip	2016/08/13 2:02	55,9 KB
R1-167099.zip	2016/08/13 2:02	59,8 KB
R1-167100.zip	2016/08/13 2:02	19,3 KB
R1-167101.zip	2016/08/13 2:02	40,7 KB
R1-167102.zip	2016/08/13 2:02	109,4 KB
R1-167103.zip	2016/08/13 2:02	43,3 KB
R1-167104.zip	2016/08/13 2:02	208 KB
R1-167105.zip	2016/08/13 2:02	98,5 KB
R1-167106.zip	2016/08/13 2:03	555,1 KB
R1-167107.zip	2016/08/13 2:03	98 KB
R1-167108.zip	2016/08/13 2:03	205,4 KB
R1-167109.zip	2016/08/13 2:03	130,3 KB
R1-167110.zip	2016/08/13 2:03	115,8 KB
R1-167111.zip	2016/08/13 2:03	101,1 KB
R1-167112.zip	2016/08/13 2:03	43,2 KB
R1-167113.zip	2016/08/13 2:04	86,3 KB
R1-167114.zip	2016/08/13 2:04	248,9 KB
R1-167115.zip	2016/08/13 2:04	144,5 KB
R1-167116.zip	2016/08/13 2:04	168,3 KB
R1-167117.zip	2016/08/13 2:04	185 KB
R1-167119.zip	2016/08/13 6:02	397,7 KB
R1-167120.zip	2016/08/13 6:09	321,3 KB
R1-167121.zip	2016/08/13 6:09	160,4 KB
R1-167122.zip	2016/08/13 6:09	164,8 KB
R1-167123.zip	2016/08/13 6:09	153,8 KB
R1-167124.zip	2016/08/13 6:19	86,2 KB
R1-167125.zip	2016/08/13 6:09	1287 KB
R1-167126.zip	2016/08/13 6:10	441,5 KB
R1-167127.zip	2016/08/13 6:19	650,8 KB
R1-167128.zip	2016/08/13 6:10	167,8 KB

Petitioners' Exhibit 1007, p. 1577
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sort by name/desc	sort by date/desc	sort by size/desc
R1-167129.zip	2016/08/13 6:10	195,2 KB
R1-167130.zip	2016/08/13 6:10	673,8 KB
R1-167131.zip	2016/08/12 21:45	96 KB
R1-167132.zip	2016/08/12 21:24	155,6 KB
R1-167133.zip	2016/08/12 21:24	190,1 KB
R1-167134.zip	2016/08/12 21:24	152,2 KB
R1-167135.zip	2016/08/12 21:24	48,6 KB
R1-167136.zip	2016/08/12 21:24	46,3 KB
R1-167137.zip	2016/08/12 21:24	161 KB
R1-167138.zip	2016/08/12 21:24	197,6 KB
R1-167139.zip	2016/08/12 21:24	319,8 KB
R1-167140.zip	2016/08/12 21:24	144,4 KB
R1-167141.zip	2016/08/12 21:24	29,5 KB
R1-167142.zip	2016/08/13 3:07	680 KB
R1-167143.zip	2016/08/12 21:24	119,7 KB
R1-167144.zip	2016/08/12 21:24	114,4 KB
R1-167145.zip	2016/08/12 21:24	87,1 KB
R1-167146.zip	2016/08/12 21:25	38,5 KB
R1-167147.zip	2016/08/12 21:45	75,4 KB
R1-167148.zip	2016/08/12 21:25	43,8 KB
R1-167149.zip	2016/08/12 21:25	56,7 KB
R1-167150.zip	2016/08/12 21:25	104,6 KB
R1-167151.zip	2016/08/12 21:25	165,6 KB
R1-167152.zip	2016/08/12 21:25	66,7 KB
R1-167153.zip	2016/08/12 21:25	48,1 KB
R1-167154.zip	2016/08/12 21:25	29,6 KB
R1-167155.zip	2016/08/12 21:25	30 KB
R1-167156.zip	2016/08/12 21:25	24,7 KB
R1-167157.zip	2016/08/12 21:25	50,3 KB
R1-167158.zip	2016/08/12 21:25	47 KB
R1-167159.zip	2016/08/12 21:25	243,9 KB
R1-167160.zip	2016/08/12 21:25	116,6 KB
R1-167161.zip	2016/08/12 21:25	43,1 KB
R1-167162.zip	2016/08/12 21:25	175,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167163.zip	2016/08/12 21:25	31,4 KB
R1-167164.zip	2016/08/12 21:25	34,6 KB
R1-167165.zip	2016/08/12 21:25	122,5 KB
R1-167166.zip	2016/08/12 21:25	31,9 KB
R1-167167.zip	2016/08/12 21:25	150,3 KB
R1-167168.zip	2016/08/12 21:25	50,8 KB
R1-167169.zip	2016/08/12 21:25	236,6 KB
R1-167170.zip	2016/08/12 21:25	29,7 KB
R1-167171.zip	2016/08/12 21:26	106,3 KB
R1-167172.zip	2016/08/12 21:26	34,4 KB
R1-167173.zip	2016/08/12 21:26	33,3 KB
R1-167174.zip	2016/08/12 21:26	41,2 KB
R1-167175.zip	2016/08/12 21:26	256,2 KB
R1-167176.zip	2016/08/12 21:26	406,9 KB
R1-167177.zip	2016/08/12 21:45	85,9 KB
R1-167178.zip	2016/08/12 21:26	29,2 KB
R1-167180.zip	2016/08/12 21:26	27,6 KB
R1-167181.zip	2016/08/12 21:26	44 KB
R1-167182.zip	2016/08/12 21:26	92,2 KB
R1-167183.zip	2016/08/12 21:26	27,3 KB
R1-167184.zip	2016/08/12 21:26	24,2 KB
R1-167185.zip	2016/08/12 21:26	27,2 KB
R1-167186.zip	2016/08/12 21:26	26,8 KB
R1-167187.zip	2016/08/12 21:26	25,1 KB
R1-167188.zip	2016/08/12 21:26	33,5 KB
R1-167189.zip	2016/08/12 21:45	100,3 KB
R1-167190.zip	2016/08/12 21:26	240,1 KB
R1-167191.zip	2016/08/13 6:10	26,2 KB
R1-167192.zip	2016/08/13 6:10	26,2 KB
R1-167193.zip	2016/08/13 6:10	15,3 KB
R1-167194.zip	2016/08/13 6:10	111,3 KB
R1-167195.zip	2016/08/12 19:26	90,8 KB
R1-167196.zip	2016/08/12 19:26	421,2 KB
R1-167197.zip	2016/08/12 20:42	190,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167198.zip	2016/08/12 20:42	556,2 KB
R1-167199.zip	2016/08/12 20:43	216,9 KB
R1-167200.zip	2016/08/12 20:43	160,1 KB
R1-167201.zip	2016/08/13 3:08	641,3 KB
R1-167202.zip	2016/08/12 20:43	383,1 KB
R1-167203.zip	2016/08/12 20:43	105,5 KB
R1-167204.zip	2016/08/12 20:43	280,3 KB
R1-167205.zip	2016/08/12 20:43	92,7 KB
R1-167206.zip	2016/08/12 20:43	91,4 KB
R1-167207.zip	2016/08/12 20:43	462 KB
R1-167208.zip	2016/08/12 20:43	243 KB
R1-167209.zip	2016/08/13 0:28	355,3 KB
R1-167210.zip	2016/08/13 0:28	220,3 KB
R1-167211.zip	2016/08/13 0:28	245,7 KB
R1-167212.zip	2016/08/13 0:28	195,7 KB
R1-167213.zip	2016/08/13 0:28	318,9 KB
R1-167214.zip	2016/08/13 0:28	99,9 KB
R1-167215.zip	2016/08/13 0:28	768,5 KB
R1-167216.zip	2016/08/13 0:28	761,2 KB
R1-167217.zip	2016/08/12 23:36	322,3 KB
R1-167218.zip	2016/08/12 20:43	168,9 KB
R1-167219.zip	2016/08/12 20:43	2480,4 KB
R1-167220.zip	2016/08/12 20:43	544,8 KB
R1-167221.zip	2016/08/12 20:43	79,5 KB
R1-167222.zip	2016/08/12 20:43	175,6 KB
R1-167223.zip	2016/08/12 20:43	29,3 KB
R1-167224.zip	2016/08/12 23:36	636,8 KB
R1-167225.zip	2016/08/12 20:43	62 KB
R1-167226.zip	2016/08/12 20:43	65,5 KB
R1-167227.zip	2016/08/12 20:43	27,2 KB
R1-167228.zip	2016/08/12 20:43	27,4 KB
R1-167229.zip	2016/08/12 20:43	137,4 KB
R1-167230.zip	2016/08/12 20:43	256 KB
R1-167231.zip	2016/08/12 20:43	25,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167232.zip	2016/08/12 20:43	19,4 KB
R1-167233.zip	2016/08/12 20:43	29,1 KB
R1-167234.zip	2016/08/12 20:43	25,7 KB
R1-167235.zip	2016/08/12 20:43	27,6 KB
R1-167236.zip	2016/08/12 20:43	181,3 KB
R1-167237.zip	2016/08/12 20:43	21,3 KB
R1-167238.zip	2016/08/12 20:43	17,5 KB
R1-167239.zip	2016/08/13 0:28	1756 KB
R1-167240.zip	2016/08/13 0:28	239,3 KB
R1-167241.zip	2016/08/12 20:00	8094,9 KB
R1-167242.zip	2016/08/12 20:43	18,8 KB
R1-167243.zip	2016/08/12 18:55	288,9 KB
R1-167244.zip	2016/08/16 12:57	844,1 KB
R1-167245.zip	2016/08/12 18:55	892,2 KB
R1-167246.zip	2016/08/12 18:55	1304,9 KB
R1-167247.zip	2016/08/12 20:40	105,2 KB
R1-167248.zip	2016/08/12 20:40	257,1 KB
R1-167249.zip	2016/08/12 20:40	185 KB
R1-167250.zip	2016/08/12 20:40	186,4 KB
R1-167251.zip	2016/08/12 20:40	109,1 KB
R1-167252.zip	2016/08/12 20:40	50,5 KB
R1-167253.zip	2016/08/12 20:40	45,6 KB
R1-167254.zip	2016/08/12 20:41	275 KB
R1-167255.zip	2016/08/12 20:41	57,9 KB
R1-167256.zip	2016/08/12 20:40	140,4 KB
R1-167257.zip	2016/08/12 20:40	219,2 KB
R1-167258.zip	2016/08/12 18:52	80 KB
R1-167259.zip	2016/08/12 18:52	88,9 KB
R1-167260.zip	2016/08/12 18:52	78,3 KB
R1-167261.zip	2016/08/12 18:52	150,1 KB
R1-167262.zip	2016/08/12 19:26	52,6 KB
R1-167263.zip	2016/08/12 19:26	120 KB
R1-167264.zip	2016/08/12 19:26	61,7 KB
R1-167265.zip	2016/08/12 19:26	186,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167266.zip	2016/08/12 19:26	67,1 KB
R1-167267.zip	2016/08/12 19:26	105,8 KB
R1-167268.zip	2016/08/12 19:26	383,1 KB
R1-167269.zip	2016/08/12 19:26	136,2 KB
R1-167270.zip	2016/08/12 19:26	1338 KB
R1-167271.zip	2016/08/12 19:27	2459,1 KB
R1-167272.zip	2016/08/12 19:27	65,3 KB
R1-167273.zip	2016/08/12 19:25	206,6 KB
R1-167274.zip	2016/08/12 19:25	320,3 KB
R1-167275.zip	2016/08/12 19:26	961,6 KB
R1-167276.zip	2016/08/12 19:26	89,4 KB
R1-167277.zip	2016/08/12 19:26	61 KB
R1-167278.zip	2016/08/12 19:26	63,7 KB
R1-167279.zip	2016/08/12 20:40	166,9 KB
R1-167280.zip	2016/08/12 20:40	124,2 KB
R1-167281.zip	2016/08/12 20:40	37,6 KB
R1-167282.zip	2016/08/12 20:40	201,8 KB
R1-167283.zip	2016/08/12 20:40	33,9 KB
R1-167284.zip	2016/08/12 20:40	84,2 KB
R1-167285.zip	2016/08/12 20:40	51,2 KB
R1-167286.zip	2016/08/12 20:40	35,2 KB
R1-167287.zip	2016/08/12 20:40	347,6 KB
R1-167288.zip	2016/08/12 20:40	225 KB
R1-167290.zip	2016/08/12 20:40	37,8 KB
R1-167291.zip	2016/08/12 20:40	104,8 KB
R1-167292.zip	2016/08/12 20:40	351,8 KB
R1-167293.zip	2016/08/12 20:40	458 KB
R1-167294.zip	2016/08/12 17:45	35,3 KB
R1-167295.zip	2016/08/12 17:45	35,9 KB
R1-167296.zip	2016/08/12 17:45	117,9 KB
R1-167297.zip	2016/08/12 19:40	33,1 KB
R1-167298.zip	2016/08/12 19:44	35,5 KB
R1-167299.zip	2016/08/12 20:12	35,1 KB
R1-167300.zip	2016/08/12 20:12	100,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167301.zip	2016/08/12 20:12	94,6 KB
R1-167302.zip	2016/08/12 20:13	87,5 KB
R1-167303.zip	2016/08/12 20:13	279,8 KB
R1-167304.zip	2016/08/12 20:12	29,6 KB
R1-167305.zip	2016/08/12 20:12	109 KB
R1-167306.zip	2016/08/12 20:26	246,5 KB
R1-167307.zip	2016/08/12 20:12	33 KB
R1-167308.zip	2016/08/12 20:12	92 KB
R1-167309.zip	2016/08/12 20:12	162,6 KB
R1-167310.zip	2016/08/13 6:08	819,6 KB
R1-167311.zip	2016/08/13 4:01	32,3 KB
R1-167312.zip	2016/08/13 3:06	31,4 KB
R1-167313.zip	2016/08/13 3:06	45,6 KB
R1-167314.zip	2016/08/13 3:06	59 KB
R1-167315.zip	2016/08/13 3:06	77,3 KB
R1-167316.zip	2016/08/13 3:06	212,6 KB
R1-167317.zip	2016/08/13 3:06	53 KB
R1-167318.zip	2016/08/13 3:06	185,5 KB
R1-167319.zip	2016/08/13 3:06	379 KB
R1-167320.zip	2016/08/13 3:06	56,9 KB
R1-167321.zip	2016/08/13 5:53	54,7 KB
R1-167322.zip	2016/08/13 5:53	201,2 KB
R1-167323.zip	2016/08/13 5:53	177,5 KB
R1-167324.zip	2016/08/13 5:53	65 KB
R1-167325.zip	2016/08/13 3:06	52,7 KB
R1-167326.zip	2016/08/13 3:06	50,7 KB
R1-167327.zip	2016/08/12 20:34	31,1 KB
R1-167328.zip	2016/08/12 20:34	30,8 KB
R1-167329.zip	2016/08/12 20:34	88,6 KB
R1-167330.zip	2016/08/12 20:34	31,6 KB
R1-167331.zip	2016/08/12 20:34	181,6 KB
R1-167332.zip	2016/08/12 20:34	142,7 KB
R1-167333.zip	2016/08/12 20:34	34,7 KB
R1-167334.zip	2016/08/12 10:09	85 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167335.zip	2016/08/12 20:43	169,3 KB
R1-167336.zip	2016/08/12 20:43	112 KB
R1-167337.zip	2016/08/12 8:29	1921,4 KB
R1-167338.zip	2016/08/12 8:29	85,3 KB
R1-167339.zip	2016/08/12 6:04	220,2 KB
R1-167340.zip	2016/08/12 6:04	366 KB
R1-167341.zip	2016/08/12 7:09	161,6 KB
R1-167342.zip	2016/08/12 7:06	63,3 KB
R1-167343.zip	2016/08/12 9:46	83,6 KB
R1-167344.zip	2016/08/12 9:47	77,4 KB
R1-167345.zip	2016/08/12 9:47	29,7 KB
R1-167346.zip	2016/08/13 3:31	139,8 KB
R1-167347.zip	2016/08/13 3:31	47,4 KB
R1-167348.zip	2016/08/13 3:31	234,7 KB
R1-167349.zip	2016/08/13 3:31	81,7 KB
R1-167350.zip	2016/08/13 3:31	127,2 KB
R1-167351.zip	2016/08/13 3:31	207,1 KB
R1-167352.zip	2016/08/12 9:48	62,1 KB
R1-167353.zip	2016/08/12 9:48	40,8 KB
R1-167354.zip	2016/08/12 9:48	61 KB
R1-167355.zip	2016/08/12 11:46	178,4 KB
R1-167356.zip	2016/08/12 11:46	58,6 KB
R1-167357.zip	2016/08/12 11:46	73,9 KB
R1-167358.zip	2016/08/12 11:46	71,9 KB
R1-167359.zip	2016/08/12 11:46	45,6 KB
R1-167360.zip	2016/08/12 11:46	33,3 KB
R1-167361.zip	2016/08/12 11:46	143,1 KB
R1-167362.zip	2016/08/12 11:46	74,6 KB
R1-167363.zip	2016/08/13 2:59	159,1 KB
R1-167364.zip	2016/08/13 2:59	392,6 KB
R1-167365.zip	2016/08/13 2:59	78,9 KB
R1-167366.zip	2016/08/13 2:09	76,8 KB
R1-167367.zip	2016/08/13 2:09	273,4 KB
R1-167368.zip	2016/08/13 2:09	148,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167369.zip	2016/08/13 2:09	227 KB
R1-167370.zip	2016/08/13 2:09	539 KB
R1-167371.zip	2016/08/13 2:09	225,6 KB
R1-167372.zip	2016/08/13 2:09	362,8 KB
R1-167373.zip	2016/08/13 2:59	395,7 KB
R1-167374.zip	2016/08/13 2:59	280,3 KB
R1-167375.zip	2016/08/13 2:59	16,8 KB
R1-167376.zip	2016/08/13 2:59	1064,7 KB
R1-167377.zip	2016/08/13 2:59	351,4 KB
R1-167378.zip	2016/08/13 2:59	275,2 KB
R1-167379.zip	2016/08/12 9:47	322,6 KB
R1-167380.zip	2016/08/13 3:32	366,7 KB
R1-167381.zip	2016/08/13 3:32	66,2 KB
R1-167382.zip	2016/08/13 3:32	85,4 KB
R1-167383.zip	2016/08/13 3:32	134,9 KB
R1-167384.zip	2016/08/13 3:32	145,6 KB
R1-167385.zip	2016/08/13 3:32	72,6 KB
R1-167386.zip	2016/08/12 9:47	71,5 KB
R1-167387.zip	2016/08/13 3:32	94,3 KB
R1-167388.zip	2016/08/13 3:32	73,3 KB
R1-167389.zip	2016/08/13 3:32	51,9 KB
R1-167390.zip	2016/08/12 11:46	45,3 KB
R1-167391.zip	2016/08/12 11:46	89,4 KB
R1-167392.zip	2016/08/13 2:59	390,2 KB
R1-167393.zip	2016/08/13 2:59	326,9 KB
R1-167394.zip	2016/08/13 2:09	1322 KB
R1-167395.zip	2016/08/13 2:09	160,5 KB
R1-167396.zip	2016/08/13 2:09	179,1 KB
R1-167397.zip	2016/08/13 2:09	210,7 KB
R1-167398.zip	2016/08/12 21:26	27 KB
R1-167399.zip	2016/08/12 21:26	29,2 KB
R1-167400.zip	2016/08/12 21:26	29,2 KB
R1-167401.zip	2016/08/12 21:26	26 KB
R1-167402.zip	2016/08/12 9:55	42,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167403.zip	2016/08/12 9:55	23 KB
R1-167404.zip	2016/08/12 9:55	149,6 KB
R1-167406.zip	2016/08/12 9:55	61,1 KB
R1-167407.zip	2016/08/12 9:55	47,7 KB
R1-167408.zip	2016/08/12 9:55	43,1 KB
R1-167409.zip	2016/08/12 10:02	582,6 KB
R1-167410.zip	2016/08/12 10:01	43,8 KB
R1-167411.zip	2016/08/12 10:01	33 KB
R1-167412.zip	2016/08/12 10:01	205,7 KB
R1-167413.zip	2016/08/12 8:12	357,5 KB
R1-167414.zip	2016/08/12 8:12	907,2 KB
R1-167415.zip	2016/08/13 18:19	487,4 KB
R1-167416.zip	2016/08/13 18:19	79,4 KB
R1-167418.zip	2016/08/13 18:19	36,7 KB
R1-167419.zip	2016/08/12 21:26	35 KB
R1-167420.zip	2016/08/12 12:56	25,7 KB
R1-167421.zip	2016/08/12 12:56	22,8 KB
R1-167422.zip	2016/08/12 14:56	119,7 KB
R1-167423.zip	2016/08/13 1:56	59,8 KB
R1-167424.zip	2016/08/13 1:56	123 KB
R1-167425.zip	2016/08/13 1:56	76 KB
R1-167426.zip	2016/08/13 1:56	47,5 KB
R1-167427.zip	2016/08/13 1:56	80,8 KB
R1-167428.zip	2016/08/13 1:56	107,4 KB
R1-167429.zip	2016/08/13 4:09	22,2 KB
R1-167430.zip	2016/08/13 2:55	23,1 KB
R1-167431.zip	2016/08/13 1:56	47,1 KB
R1-167432.zip	2016/08/12 10:27	39,3 KB
R1-167433.zip	2016/08/12 10:33	209,9 KB
R1-167434.zip	2016/08/12 10:33	34 KB
R1-167435.zip	2016/08/12 10:12	519,2 KB
R1-167436.zip	2016/08/12 10:12	35,1 KB
R1-167437.zip	2016/08/12 10:43	20,5 KB
R1-167438.zip	2016/08/12 10:45	24,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167439.zip	2016/08/12 14:24	121,5 KB
R1-167440.zip	2016/08/12 10:59	120,3 KB
R1-167441.zip	2016/08/12 10:48	162,8 KB
R1-167442.zip	2016/08/12 12:59	89,5 KB
R1-167443.zip	2016/08/12 12:59	23,8 KB
R1-167444.zip	2016/08/12 13:00	45,8 KB
R1-167445.zip	2016/08/12 13:00	28,8 KB
R1-167446.zip	2016/08/12 21:32	29 KB
R1-167447.zip	2016/08/12 20:32	18,7 KB
R1-167448.zip	2016/08/12 20:32	18,8 KB
R1-167449.zip	2016/08/12 20:32	128,9 KB
R1-167451.zip	2016/08/12 20:32	24,9 KB
R1-167452.zip	2016/08/12 20:32	92,4 KB
R1-167453.zip	2016/08/12 20:32	80,5 KB
R1-167454.zip	2016/08/12 20:32	51 KB
R1-167455.zip	2016/08/12 20:32	333,9 KB
R1-167457.zip	2016/08/12 20:32	38,2 KB
R1-167458.zip	2016/08/12 20:32	25,6 KB
R1-167459.zip	2016/08/12 20:32	76,3 KB
R1-167460.zip	2016/08/12 20:32	122,6 KB
R1-167461.zip	2016/08/12 20:32	115,9 KB
R1-167462.zip	2016/08/12 20:32	40,7 KB
R1-167463.zip	2016/08/12 20:32	129,3 KB
R1-167464.zip	2016/08/12 20:32	42,4 KB
R1-167465.zip	2016/08/12 20:32	51,1 KB
R1-167466.zip	2016/08/12 20:32	77,8 KB
R1-167467.zip	2016/08/12 20:32	49,8 KB
R1-167468.zip	2016/08/12 20:32	51,3 KB
R1-167469.zip	2016/08/12 20:32	41,9 KB
R1-167470.zip	2016/08/12 20:32	38,6 KB
R1-167471.zip	2016/08/12 20:32	76,8 KB
R1-167472.zip	2016/08/12 20:32	251,6 KB
R1-167473.zip	2016/08/12 20:32	140,4 KB
R1-167474.zip	2016/08/12 20:32	28,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167475.zip	2016/08/12 20:32	24,7 KB
R1-167476.zip	2016/08/12 20:32	32,1 KB
R1-167477.zip	2016/08/12 20:32	23,2 KB
R1-167478.zip	2016/08/12 20:32	35,9 KB
R1-167479.zip	2016/08/12 20:32	43 KB
R1-167480.zip	2016/08/12 20:32	41,7 KB
R1-167481.zip	2016/08/12 20:32	33,1 KB
R1-167482.zip	2016/08/12 20:32	25,9 KB
R1-167483.zip	2016/08/12 21:32	305,1 KB
R1-167484.zip	2016/08/12 21:32	87,1 KB
R1-167485.zip	2016/08/12 21:32	46,3 KB
R1-167486.zip	2016/08/12 15:43	533 KB
R1-167487.zip	2016/08/12 15:43	50,6 KB
R1-167488.zip	2016/08/12 15:43	19,4 KB
R1-167489.zip	2016/08/12 15:43	84,6 KB
R1-167490.zip	2016/08/12 15:43	24 KB
R1-167491.zip	2016/08/12 15:43	48 KB
R1-167492.zip	2016/08/12 15:43	32,2 KB
R1-167493.zip	2016/08/12 15:43	33,2 KB
R1-167494.zip	2016/08/12 15:43	24,7 KB
R1-167495.zip	2016/08/12 15:43	65,5 KB
R1-167496.zip	2016/08/12 15:43	51,8 KB
R1-167497.zip	2016/08/12 15:43	60,7 KB
R1-167498.zip	2016/08/12 15:43	18,7 KB
R1-167499.zip	2016/08/12 15:43	32,7 KB
R1-167500.zip	2016/08/12 15:43	70,9 KB
R1-167501.zip	2016/08/12 15:43	70,6 KB
R1-167502.zip	2016/08/12 15:43	16 KB
R1-167503.zip	2016/08/12 15:43	19,1 KB
R1-167504.zip	2016/08/12 15:43	94,8 KB
R1-167505.zip	2016/08/12 16:31	8,6 KB
R1-167506.zip	2016/08/12 16:31	18,6 KB
R1-167507.zip	2016/08/12 16:31	56,8 KB
R1-167508.zip	2016/08/13 2:42	83,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167509.zip	2016/08/12 23:26	73,6 KB
R1-167510.zip	2016/08/12 23:26	75,3 KB
R1-167511.zip	2016/08/13 2:42	34,1 KB
R1-167512.zip	2016/08/12 23:26	66,7 KB
R1-167513.zip	2016/08/13 2:42	33,5 KB
R1-167514.zip	2016/08/13 2:42	28,7 KB
R1-167515.zip	2016/08/13 2:42	30,6 KB
R1-167516.zip	2016/08/12 23:26	79,3 KB
R1-167517.zip	2016/08/12 23:26	107,7 KB
R1-167518.zip	2016/08/12 23:27	44,3 KB
R1-167519.zip	2016/08/12 23:27	336,7 KB
R1-167520.zip	2016/08/12 23:27	243,1 KB
R1-167521.zip	2016/08/12 15:36	142,3 KB
R1-167522.zip	2016/08/12 15:36	47,2 KB
R1-167523.zip	2016/08/12 15:36	68,6 KB
R1-167524.zip	2016/08/12 15:37	23,4 KB
R1-167525.zip	2016/08/12 15:37	128,3 KB
R1-167526.zip	2016/08/12 15:37	225 KB
R1-167527.zip	2016/08/12 15:45	1832,1 KB
R1-167528.zip	2016/08/12 15:43	694 KB
R1-167529.zip	2016/08/13 3:06	175,9 KB
R1-167530.zip	2016/08/13 3:06	216,6 KB
R1-167531.zip	2016/08/12 15:43	78 KB
R1-167532.zip	2016/08/12 15:43	667,8 KB
R1-167533.zip	2016/08/12 15:43	564,1 KB
R1-167534.zip	2016/08/12 15:43	52,5 KB
R1-167535.zip	2016/08/12 15:43	324,7 KB
R1-167536.zip	2016/08/12 15:43	318,6 KB
R1-167537.zip	2016/08/12 15:43	159 KB
R1-167538.zip	2016/08/12 15:43	177,3 KB
R1-167539.zip	2016/08/13 3:06	248,8 KB
R1-167540.zip	2016/08/12 15:43	32,3 KB
R1-167541.zip	2016/08/13 3:07	96 KB
R1-167542.zip	2016/08/13 5:58	136,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167543.zip	2016/08/12 15:43	262,3 KB
R1-167544.zip	2016/08/28 14:14	79 KB
R1-167545.zip	2016/08/12 21:38	829,7 KB
R1-167546.zip	2016/08/12 18:24	195 KB
R1-167547.zip	2016/08/12 16:01	23,3 KB
R1-167548.zip	2016/08/12 10:01	69,2 KB
R1-167549.zip	2016/08/12 16:01	23,2 KB
R1-167550.zip	2016/08/12 12:59	95,3 KB
R1-167551.zip	2016/08/19 8:31	5553,4 KB
R1-167552.zip	2016/08/19 8:30	159,9 KB
R1-167553.zip	2016/08/12 20:32	49,6 KB
R1-167554.zip	2016/08/12 19:40	71,5 KB
R1-167555.zip	2016/08/12 19:40	91,2 KB
R1-167556.zip	2016/08/12 14:31	117,5 KB
R1-167557.zip	2016/08/12 14:31	72,8 KB
R1-167558.zip	2016/08/12 18:18	656,3 KB
R1-167559.zip	2016/08/12 18:23	275,6 KB
R1-167560.zip	2016/08/12 18:23	239,9 KB
R1-167561.zip	2016/08/12 18:23	368,5 KB
R1-167562.zip	2016/08/12 18:23	137,5 KB
R1-167563.zip	2016/08/12 18:23	50 KB
R1-167564.zip	2016/08/12 18:24	149,7 KB
R1-167565.zip	2016/08/12 18:24	306,2 KB
R1-167566.zip	2016/08/12 18:24	201,9 KB
R1-167567.zip	2016/08/12 18:25	196,5 KB
R1-167568.zip	2016/08/12 18:25	1149,8 KB
R1-167569.zip	2016/08/12 18:25	167,1 KB
R1-167570.zip	2016/08/12 18:25	189,9 KB
R1-167571.zip	2016/08/12 18:26	311,2 KB
R1-167572.zip	2016/08/12 18:26	123,4 KB
R1-167573.zip	2016/08/12 18:26	75,1 KB
R1-167574.zip	2016/08/12 18:26	31 KB
R1-167575.zip	2016/08/12 18:27	59,3 KB
R1-167576.zip	2016/08/12 16:23	83,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167577.zip	2016/08/12 21:21	246,8 KB
R1-167578.zip	2016/08/12 18:27	182,7 KB
R1-167579.zip	2016/08/12 19:19	57 KB
R1-167580.zip	2016/08/12 19:19	53,2 KB
R1-167581.zip	2016/08/28 14:14	44,8 KB
R1-167582.zip	2016/08/12 21:21	181,7 KB
R1-167584.zip	2016/08/12 17:42	150,2 KB
R1-167585.zip	2016/08/12 17:42	606,9 KB
R1-167586.zip	2016/08/12 20:10	47 KB
R1-167587.zip	2016/08/12 20:10	43,3 KB
R1-167588.zip	2016/08/12 20:10	72,4 KB
R1-167589.zip	2016/08/12 20:10	47,9 KB
R1-167590.zip	2016/08/12 20:10	44,3 KB
R1-167591.zip	2016/08/12 20:10	43,7 KB
R1-167592.zip	2016/08/12 20:10	44,1 KB
R1-167593.zip	2016/08/13 3:19	120,3 KB
R1-167594.zip	2016/08/13 3:20	144,9 KB
R1-167595.zip	2016/08/13 3:19	366,6 KB
R1-167596.zip	2016/08/12 23:11	128,5 KB
R1-167597.zip	2016/08/12 23:11	52,6 KB
R1-167598.zip	2016/08/12 23:11	300 KB
R1-167599.zip	2016/08/12 23:11	406,2 KB
R1-167600.zip	2016/08/12 6:36	59,2 KB
R1-167601.zip	2016/08/12 6:36	63,4 KB
R1-167602.zip	2016/08/12 6:36	53,5 KB
R1-167603.zip	2016/08/12 8:31	19,7 KB
R1-167604.zip	2016/08/13 6:02	631,5 KB
R1-167605.zip	2016/08/12 17:18	56,9 KB
R1-167606.zip	2016/08/12 17:18	54,2 KB
R1-167607.zip	2016/08/12 17:18	61,5 KB
R1-167608.zip	2016/08/12 17:18	70,2 KB
R1-167609.zip	2016/08/12 17:18	64,5 KB
R1-167610.zip	2016/08/12 17:18	105,4 KB
R1-167611.zip	2016/08/12 17:18	69,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167612.zip	2016/08/19 6:50	149 KB
R1-167613.zip	2016/08/12 17:18	176,4 KB
R1-167614.zip	2016/08/12 17:18	261,4 KB
R1-167615.zip	2016/08/12 17:18	334,1 KB
R1-167616.zip	2016/08/12 17:18	107,5 KB
R1-167617.zip	2016/08/12 17:18	266,7 KB
R1-167618.zip	2016/08/12 8:16	22,8 KB
R1-167619.zip	2016/08/12 8:16	47,8 KB
R1-167620.zip	2016/08/12 8:16	185,8 KB
R1-167621.zip	2016/08/12 9:54	34,5 KB
R1-167622.zip	2016/08/13 9:57	15 KB
R1-167623.zip	2016/08/13 9:57	44,5 KB
R1-167624.zip	2016/08/13 2:41	319,9 KB
R1-167625.zip	2016/08/12 22:09	88,6 KB
R1-167626.zip	2016/08/12 22:09	84 KB
R1-167627.zip	2016/08/12 22:09	104,1 KB
R1-167628.zip	2016/08/13 5:16	32 KB
R1-167629.zip	2016/08/13 5:17	40,9 KB
R1-167631.zip	2016/08/13 5:59	20,5 KB
R1-167632.zip	2016/08/13 5:17	66,6 KB
R1-167633.zip	2016/08/13 6:00	227,2 KB
R1-167634.zip	2016/08/13 6:00	130,9 KB
R1-167635.zip	2016/08/13 6:00	100,8 KB
R1-167636.zip	2016/08/13 6:09	62,3 KB
R1-167637.zip	2016/08/13 6:17	62,2 KB
R1-167638.zip	2016/08/13 6:00	130,7 KB
R1-167639.zip	2016/08/13 6:31	355,8 KB
R1-167640.zip	2016/08/13 6:06	131,4 KB
R1-167641.zip	2016/08/13 6:06	161,7 KB
R1-167642.zip	2016/08/13 6:24	78,9 KB
R1-167643.zip	2016/08/13 6:37	149,6 KB
R1-167644.zip	2016/08/13 6:32	66 KB
R1-167645.zip	2016/08/13 6:35	152,5 KB
R1-167646.zip	2016/08/13 6:20	112 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167647.zip	2016/08/13 6:10	90,4 KB
R1-167648.zip	2016/08/13 6:10	281,7 KB
R1-167649.zip	2016/08/13 6:20	119 KB
R1-167650.zip	2016/08/12 21:21	186,7 KB
R1-167651.zip	2016/08/12 18:11	31,7 KB
R1-167652.zip	2016/08/12 18:11	58,9 KB
R1-167653.zip	2016/08/12 18:11	31,9 KB
R1-167654.zip	2016/08/12 18:11	62,2 KB
R1-167655.zip	2016/08/12 18:11	31,7 KB
R1-167656.zip	2016/08/12 18:11	154 KB
R1-167657.zip	2016/08/12 18:11	32,3 KB
R1-167658.zip	2016/08/12 18:11	64,2 KB
R1-167659.zip	2016/08/12 5:46	1095,1 KB
R1-167661.zip	2016/08/13 4:13	333,5 KB
R1-167662.zip	2016/08/13 4:13	43,4 KB
R1-167663.zip	2016/08/13 4:13	173,5 KB
R1-167664.zip	2016/08/13 4:13	51,9 KB
R1-167665.zip	2016/08/13 4:13	25,5 KB
R1-167666.zip	2016/08/13 4:13	118,3 KB
R1-167667.zip	2016/08/13 4:13	81,8 KB
R1-167668.zip	2016/08/13 4:13	24,9 KB
R1-167669.zip	2016/08/13 4:13	70 KB
R1-167670.zip	2016/08/13 4:13	22 KB
R1-167671.zip	2016/08/13 4:13	53,1 KB
R1-167672.zip	2016/08/13 2:16	25,1 KB
R1-167673.zip	2016/08/13 2:17	27,2 KB
R1-167674.zip	2016/08/12 21:26	351,2 KB
R1-167675.zip	2016/08/12 21:26	21,2 KB
R1-167676.zip	2016/08/12 21:26	49,5 KB
R1-167677.zip	2016/08/12 21:26	38,5 KB
R1-167678.zip	2016/08/12 21:26	211,6 KB
R1-167679.zip	2016/08/12 21:26	25,2 KB
R1-167680.zip	2016/08/12 21:26	34,9 KB
R1-167681.zip	2016/08/13 1:00	49,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167682.zip	2016/08/13 1:00	72,6 KB
R1-167683.zip	2016/08/13 1:00	285,2 KB
R1-167684.zip	2016/08/13 1:00	152,1 KB
R1-167685.zip	2016/08/13 1:00	110,1 KB
R1-167686.zip	2016/08/13 1:00	31,7 KB
R1-167687.zip	2016/08/13 1:00	40,1 KB
R1-167688.zip	2016/08/12 15:53	345,8 KB
R1-167689.zip	2016/08/12 15:53	135,5 KB
R1-167690.zip	2016/08/12 15:53	45,8 KB
R1-167692.zip	2016/08/13 6:10	142,8 KB
R1-167693.zip	2016/08/13 6:10	254,1 KB
R1-167694.zip	2016/08/13 6:10	1079,3 KB
R1-167695.zip	2016/08/13 6:11	72,2 KB
R1-167696.zip	2016/08/13 6:11	63,1 KB
R1-167697.zip	2016/08/13 6:11	320,1 KB
R1-167698.zip	2016/08/13 6:30	157 KB
R1-167699.zip	2016/08/13 6:30	2102,7 KB
R1-167700.zip	2016/08/13 6:30	513 KB
R1-167702.zip	2016/08/13 6:11	414,4 KB
R1-167703.zip	2016/08/13 6:11	463,1 KB
R1-167704.zip	2016/08/13 6:11	411,3 KB
R1-167705.zip	2016/08/13 6:11	218,7 KB
R1-167706.zip	2016/08/13 8:25	44,3 KB
R1-167707.zip	2016/08/13 6:11	282,5 KB
R1-167708.zip	2016/08/13 6:11	228,3 KB
R1-167709.zip	2016/08/13 1:00	21,1 KB
R1-167710.zip	2016/08/13 1:00	20,8 KB
R1-167711.zip	2016/08/13 1:00	28,8 KB
R1-167712.zip	2016/08/13 5:00	148,8 KB
R1-167713.zip	2016/08/13 4:42	134,2 KB
R1-167714.zip	2016/08/12 15:01	41,7 KB
R1-167715.zip	2016/08/12 10:16	33,6 KB
R1-167716.zip	2016/08/12 10:16	25,1 KB
R1-167717.zip	2016/08/12 10:16	30,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167718.zip	2016/08/12 15:01	156,8 KB
R1-167719.zip	2016/08/13 5:17	172,4 KB
R1-167720.zip	2016/08/13 5:17	42,2 KB
R1-167721.zip	2016/08/13 5:17	41,4 KB
R1-167722.zip	2016/08/13 5:17	43 KB
R1-167723.zip	2016/08/13 5:17	74,5 KB
R1-167724.zip	2016/08/13 5:17	72,8 KB
R1-167725.zip	2016/08/13 5:17	41 KB
R1-167726.zip	2016/08/13 5:17	614,6 KB
R1-167727.zip	2016/08/13 5:17	41,8 KB
R1-167728.zip	2016/08/13 5:17	42 KB
R1-167729.zip	2016/08/13 5:17	44 KB
R1-167730.zip	2016/08/12 13:53	139,7 KB
R1-167731.zip	2016/08/12 9:48	102,6 KB
R1-167732.zip	2016/08/12 13:53	98,5 KB
R1-167733.zip	2016/08/12 8:05	73,8 KB
R1-167734.zip	2016/08/12 13:05	50,7 KB
R1-167735.zip	2016/08/12 13:05	38,6 KB
R1-167736.zip	2016/08/12 13:05	36,7 KB
R1-167737.zip	2016/08/12 16:45	29,2 KB
R1-167739.zip	2016/08/12 9:50	85 KB
R1-167740.zip	2016/08/12 9:50	23 KB
R1-167741.zip	2016/08/12 9:43	31,8 KB
R1-167742.zip	2016/08/12 10:14	1115,3 KB
R1-167743.zip	2016/08/12 16:55	68,3 KB
R1-167744.zip	2016/08/12 19:40	53,7 KB
R1-167745.zip	2016/08/12 16:55	27,8 KB
R1-167746.zip	2016/08/12 19:40	26,1 KB
R1-167748.zip	2016/08/13 3:08	28,1 KB
R1-167749.zip	2016/08/13 3:08	58 KB
R1-167750.zip	2016/08/13 8:03	69,4 KB
R1-167751.zip	2016/08/13 8:03	75,7 KB
R1-167752.zip	2016/08/13 8:03	151,1 KB
R1-167753.zip	2016/08/13 8:03	157,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167754.zip	2016/08/13 8:03	56 KB
R1-167755.zip	2016/08/12 9:48	177,2 KB
R1-167756.zip	2016/08/12 10:07	46,2 KB
R1-167757.zip	2016/08/12 10:10	133,4 KB
R1-167758.zip	2016/08/12 21:41	18,8 KB
R1-167759.zip	2016/08/12 21:41	18,8 KB
R1-167760.zip	2016/08/12 21:41	20 KB
R1-167761.zip	2016/08/12 21:41	20 KB
R1-167762.zip	2016/08/12 21:41	19,6 KB
R1-167763.zip	2016/08/12 21:41	19,6 KB
R1-167764.zip	2016/08/12 21:41	34,6 KB
R1-167765.zip	2016/08/12 21:41	55,8 KB
R1-167766.zip	2016/08/12 21:41	89,7 KB
R1-167767.zip	2016/08/12 21:41	38,4 KB
R1-167768.zip	2016/08/12 21:41	61,4 KB
R1-167769.zip	2016/08/12 16:05	81,4 KB
R1-167770.zip	2016/08/13 18:16	26,5 KB
R1-167771.zip	2016/08/13 3:10	38,7 KB
R1-167772.zip	2016/08/13 3:10	143,7 KB
R1-167773.zip	2016/08/12 20:32	14,6 KB
R1-167774.zip	2016/08/12 11:06	259,2 KB
R1-167775.zip	2016/08/12 11:06	49,1 KB
R1-167776.zip	2016/08/12 11:06	31,5 KB
R1-167777.zip	2016/08/12 11:06	29,6 KB
R1-167778.zip	2016/08/12 18:56	86,9 KB
R1-167779.zip	2016/08/12 18:56	28,8 KB
R1-167780.zip	2016/08/13 5:38	29,4 KB
R1-167781.zip	2016/08/13 5:38	25,2 KB
R1-167782.zip	2016/08/13 1:56	32,7 KB
R1-167783.zip	2016/08/13 1:56	35,8 KB
R1-167784.zip	2016/08/12 15:01	50 KB
R1-167785.zip	2016/08/13 5:38	28,6 KB
R1-167786.zip	2016/08/13 6:12	235,6 KB
R1-167787.zip	2016/08/13 6:12	64,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167788.zip	2016/08/13 6:12	152,7 KB
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R1-167790.zip	2016/08/12 13:23	51,4 KB
R1-167791.zip	2016/08/13 3:40	605,8 KB
R1-167792.zip	2016/08/12 21:50	254,2 KB
R1-167793.zip	2016/08/13 5:39	23,3 KB
R1-167794.zip	2016/08/12 18:56	89,9 KB
R1-167795.zip	2016/08/12 18:56	269,5 KB
R1-167796.zip	2016/08/12 20:10	32,7 KB
R1-167797.zip	2016/08/12 18:55	214,1 KB
R1-167798.zip	2016/08/12 15:56	51 KB
R1-167799.zip	2016/08/13 3:10	177,7 KB
R1-167800.zip	2016/08/13 5:39	24 KB
R1-167801.zip	2016/08/13 3:10	344,2 KB
R1-167802.zip	2016/08/12 23:20	69 KB
R1-167803.zip	2016/08/12 23:20	50,9 KB
R1-167804.zip	2016/08/12 23:20	32,4 KB
R1-167805.zip	2016/08/12 23:20	75 KB
R1-167806.zip	2016/08/12 16:06	23,2 KB
R1-167807.zip	2016/08/13 5:35	42,3 KB
R1-167808.zip	2016/08/13 5:35	610,5 KB
R1-167809.zip	2016/08/12 16:06	267 KB
R1-167810.zip	2016/08/13 2:14	80,6 KB
R1-167811.zip	2016/08/12 16:06	142,9 KB
R1-167812.zip	2016/08/12 16:06	74,3 KB
R1-167813.zip	2016/08/13 6:01	42,8 KB
R1-167814.zip	2016/08/13 6:15	29,7 KB
R1-167815.zip	2016/08/13 6:15	25,9 KB
R1-167817.zip	2016/08/12 14:56	73,6 KB
R1-167818.zip	2016/08/12 16:06	178,9 KB
R1-167819.zip	2016/08/12 16:06	198,1 KB
R1-167820.zip	2016/08/13 1:38	858,1 KB
R1-167821.zip	2016/08/13 4:38	1118,2 KB
R1-167822.zip	2016/08/13 5:35	27,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-167823.zip	2016/08/13 4:38	183,9 KB
R1-167824.zip	2016/08/12 16:06	29,9 KB
R1-167825.zip	2016/08/12 16:06	36,5 KB
R1-167826.zip	2016/08/12 16:06	96,6 KB
R1-167827.zip	2016/08/13 7:51	26,1 KB
R1-167828.zip	2016/08/12 14:56	14,6 KB
R1-167829.zip	2016/08/12 16:06	419,3 KB
R1-167830.zip	2016/08/12 16:06	22,6 KB
R1-167831.zip	2016/08/12 16:06	184,5 KB
R1-167832.zip	2016/08/12 16:06	24,1 KB
R1-167833.zip	2016/08/12 16:06	198,2 KB
R1-167834.zip	2016/08/12 14:30	32,7 KB
R1-167835.zip	2016/08/12 14:33	125,7 KB
R1-167836.zip	2016/08/12 16:06	18,9 KB
R1-167837.zip	2016/08/12 14:36	54,3 KB
R1-167838.zip	2016/08/20 8:43	30,6 KB
R1-167839.zip	2016/08/12 14:39	109,6 KB
R1-167840.zip	2016/08/13 4:58	98,8 KB
R1-167841.zip	2016/08/12 21:43	37,3 KB
R1-167842.zip	2016/08/12 21:43	21,8 KB
R1-167843.zip	2016/08/12 21:43	23,2 KB
R1-167845.zip	2016/08/13 5:58	493,1 KB
R1-167847.zip	2016/08/13 4:59	94,1 KB
R1-167848.zip	2016/08/13 4:13	24,9 KB
R1-167849.zip	2016/08/13 5:48	67,7 KB
R1-167852.zip	2016/08/13 5:48	56,6 KB
R1-167853.zip	2016/08/13 6:27	54,5 KB
R1-167854.zip	2016/08/13 6:42	48,2 KB
R1-167855.zip	2016/08/13 6:59	35,1 KB
R1-167856.zip	2016/08/13 7:07	29,7 KB
R1-167857.zip	2016/08/13 7:47	48,3 KB
R1-167858.zip	2016/08/13 6:06	54,7 KB
R1-167859.zip	2016/08/12 20:42	293 KB
R1-167860.zip	2016/08/12 20:42	17,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-167862.zip	2016/08/13 5:48	68,6 KB
R1-167863.zip	2016/08/12 15:49	197 KB
R1-167864.zip	2016/08/13 5:48	87,7 KB
R1-167865.zip	2016/08/13 20:40	82,7 KB
R1-167866.zip	2016/08/13 20:40	606,8 KB
R1-167867.zip	2016/08/13 20:40	166,9 KB
R1-167868.zip	2016/08/13 20:40	245,9 KB
R1-167869.zip	2016/08/16 10:12	175,7 KB
R1-167870.zip	2016/08/17 14:41	303 KB
R1-167871.zip	2016/08/28 14:14	312,3 KB
R1-167872.zip	2016/08/28 14:14	154,6 KB
R1-167873.zip	2016/08/17 15:12	858,2 KB
R1-167874.zip	2016/08/18 14:24	1146,7 KB
R1-167875.zip	2016/08/18 14:24	238,1 KB
R1-167876.zip	2016/08/19 7:05	734,2 KB
R1-167877.zip	2016/08/18 14:34	47,9 KB
R1-167878.zip	2016/08/18 13:53	132,4 KB
R1-167879.zip	2016/08/18 13:53	11,2 KB
R1-167880.zip	2016/08/18 13:53	1925,6 KB
R1-167881.zip	2016/08/18 13:53	549 KB
R1-167882.zip	2016/08/18 13:52	1838,1 KB
R1-167883.zip	2016/08/19 16:21	119,4 KB
R1-167884.zip	2016/08/18 16:00	85,6 KB
R1-167885.zip	2016/08/18 16:00	48,6 KB
R1-167886.zip	2016/08/19 7:05	70,3 KB
R1-167887.zip	2016/08/19 7:00	49,8 KB
R1-167888.zip	2016/08/19 16:21	477,7 KB
R1-167889.zip	2016/08/21 12:47	546,1 KB
R1-167890.zip	2016/08/21 20:27	31 KB
R1-167891.zip	2016/08/28 14:13	233 KB
R1-167892.zip	2016/08/28 14:13	4723,3 KB
R1-167893.zip	2016/08/28 14:13	4308,4 KB
R1-167894.zip	2016/08/21 12:47	2102,4 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-167895.zip	2016/08/20 15:30	295,2 KB
R1-167896.zip	2016/08/20 15:30	696,1 KB
R1-167897.zip	2016/08/20 15:31	279,7 KB
R1-167898.zip	2016/08/28 14:12	2925,2 KB
R1-167899.zip	2016/08/28 14:11	132,4 KB
R1-167900.zip	2016/09/08 13:52	292,6 KB
R1-167901.zip	2016/08/20 15:30	125,7 KB
R1-167902.zip	2016/08/21 12:47	27,4 KB
R1-167903.zip	2016/08/28 14:11	77,9 KB
R1-167904.zip	2016/08/28 14:11	303,9 KB
R1-167905.zip	2016/08/28 14:11	295,6 KB
R1-167906.zip	2016/08/21 20:27	13,5 KB
R1-167907.zip	2016/08/28 14:11	1804,7 KB
R1-167908.zip	2016/08/21 17:18	777,9 KB
R1-167909.zip	2016/08/28 14:11	50 KB
R1-167910.zip	2016/08/28 14:11	31,3 KB
R1-167911.zip	2016/08/28 14:11	41,4 KB
R1-167912.zip	2016/08/28 14:11	376,1 KB
R1-167913.zip	2016/08/28 14:11	266,8 KB
R1-167914.zip	2016/08/28 14:11	13,5 KB
R1-167915.zip	2016/08/28 14:11	158,2 KB
R1-167916.zip	2016/08/28 14:11	12,4 KB
R1-167917.zip	2016/08/28 14:11	17 KB
R1-167918.zip	2016/08/28 14:11	429,2 KB
R1-167919.zip	2016/08/28 14:10	26,6 KB
R1-167920.zip	2016/08/28 14:10	36,7 KB
R1-167921.zip	2016/08/28 14:11	1219,1 KB
R1-167922.zip	2016/08/28 14:10	112 KB
R1-167923.zip	2016/08/28 14:10	50,8 KB
R1-167924.zip	2016/08/28 14:10	50,9 KB
R1-167925.zip	2016/08/28 14:10	76,8 KB
R1-167926.zip	2016/08/28 14:10	156,6 KB
R1-167927.zip	2016/08/28 14:10	28,3 KB
R1-167928.zip	2016/08/28 14:10	18,7 KB

Petitioners' Exhibit 1007, p. 1600
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-167929.zip	2016/08/28 14:10	50,7 KB
R1-167930.zip	2016/08/28 14:10	96,6 KB
R1-167931.zip	2016/08/28 14:10	184,3 KB
R1-167932.zip	2016/08/28 14:10	229,4 KB
R1-167933.zip	2016/08/28 14:10	39,4 KB
R1-167934.zip	2016/08/31 10:03	22,1 KB
R1-167935.zip	2016/08/28 14:10	42,6 KB
R1-167936.zip	2016/08/28 14:10	178,1 KB
R1-167937.zip	2016/08/28 14:10	230,8 KB
R1-167938.zip	2016/08/28 14:10	52,8 KB
R1-167939.zip	2016/08/28 14:10	49,6 KB
R1-167940.zip	2016/08/28 14:10	20,3 KB
R1-167941.zip	2016/08/28 14:10	39,7 KB
R1-167942.zip	2016/08/28 14:10	38,3 KB
R1-167943.zip	2016/08/28 14:09	55,5 KB
R1-167944.zip	2016/08/28 14:10	39,6 KB
R1-167945.zip	2016/08/28 14:09	31,3 KB
R1-167946.zip	2016/08/28 14:09	38,9 KB
R1-167947.zip	2016/08/28 14:09	53,1 KB
R1-167948.zip	2016/08/28 14:09	54 KB
R1-167949.zip	2016/08/28 14:09	31,3 KB
R1-167950.zip	2016/08/28 14:09	23,8 KB
R1-167951.zip	2016/08/28 14:09	49,1 KB
R1-167952.zip	2016/08/28 14:09	28,1 KB
R1-167953.zip	2016/08/28 14:09	68,4 KB
R1-167954.zip	2016/08/28 14:09	35,9 KB
R1-167955.zip	2016/08/28 14:09	351,1 KB
R1-167956.zip	2016/08/28 14:09	50,7 KB
R1-167957.zip	2016/08/28 14:09	39,8 KB
R1-167958.zip	2016/08/28 14:09	56 KB
R1-167959.zip	2016/08/28 14:09	21,3 KB
R1-167960.zip	2016/08/28 14:09	55 KB
R1-167961.zip	2016/08/28 14:09	102 KB
R1-167962.zip	2016/08/28 14:09	112,7 KB

Petitioners' Exhibit 1007, p. 1601
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-167963.zip	2016/08/28 14:09	55,2 KB
R1-167964.zip	2016/08/28 14:09	305,5 KB
R1-167965.zip	2016/08/28 14:09	55 KB
R1-167966.zip	2016/08/28 14:09	291,5 KB
R1-167967.zip	2016/08/28 14:09	45 KB
R1-167968.zip	2016/08/28 14:09	46,6 KB
R1-167969.zip	2016/08/28 14:09	56,1 KB
R1-167970.zip	2016/08/28 14:09	35,3 KB
R1-167971.zip	2016/08/28 14:09	50,8 KB
R1-167972.zip	2016/08/28 14:09	44,5 KB
R1-167974.zip	2016/08/28 14:09	48,6 KB
R1-167975.zip	2016/08/28 14:09	29,9 KB
R1-167976.zip	2016/08/28 14:09	33,6 KB
R1-167977.zip	2016/08/28 14:09	100,4 KB
R1-167978.zip	2016/08/28 14:09	51,4 KB
R1-167979.zip	2016/08/28 14:09	69,5 KB
R1-167980.zip	2016/08/28 14:09	37,4 KB
R1-167981.zip	2016/08/28 14:09	207,6 KB
R1-167982.zip	2016/08/28 14:09	100,5 KB
R1-167983.zip	2016/08/28 14:09	45,6 KB
R1-167984.zip	2016/08/28 14:09	47,1 KB
R1-167985.zip	2016/08/28 14:09	47,1 KB
R1-167986.zip	2016/08/28 14:09	48,2 KB
R1-167987.zip	2016/08/28 14:09	44,1 KB
R1-167988.zip	2016/08/28 14:09	45,7 KB
R1-167989.zip	2016/08/28 14:09	41,6 KB
R1-167990.zip	2016/08/28 14:09	40,8 KB
R1-167991.zip	2016/08/28 14:09	33,4 KB
R1-167992.zip	2016/08/28 14:09	105,3 KB
R1-167993.zip	2016/08/28 14:09	41,8 KB
R1-167994.zip	2016/08/28 14:09	43,3 KB
R1-167995.zip	2016/08/28 14:09	45,2 KB
R1-167996.zip	2016/08/28 14:09	52,5 KB
R1-167997.zip	2016/08/28 14:09	50,5 KB

Petitioners' Exhibit 1007, p. 1602
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sort by name/desc	sort by date/desc	sort by size/desc
R1-167998.zip	2016/08/28 14:09	49,2 KB
R1-167999.zip	2016/08/28 14:09	74,9 KB
R1-168000.zip	2016/08/28 14:09	17,2 KB
R1-168001.zip	2016/08/28 14:09	43,7 KB
R1-168002.zip	2016/08/28 14:09	17,8 KB
R1-168003.zip	2016/08/28 14:09	23,2 KB
R1-168004.zip	2016/08/28 14:09	266,8 KB
R1-168005.zip	2016/08/28 14:09	75,9 KB
R1-168008.zip	2016/08/28 14:09	189,6 KB
R1-168009.zip	2016/08/28 14:09	76,2 KB
R1-168010.zip	2016/08/28 14:09	29,3 KB
R1-168011.zip	2016/08/28 14:09	17,5 KB
R1-168012.zip	2016/08/28 14:09	103 KB
R1-168013.zip	2016/08/28 14:09	44,5 KB
R1-168014.zip	2016/08/28 14:09	25,4 KB
R1-168015.zip	2016/08/28 14:09	22,4 KB
R1-168016.zip	2016/08/28 14:09	85,2 KB
R1-168017.zip	2016/08/28 14:09	32,8 KB
R1-168018.zip	2016/08/28 14:09	18,7 KB
R1-168019.zip	2016/08/28 14:09	216,1 KB
R1-168020.zip	2016/08/28 14:08	45 KB
R1-168021.zip	2016/08/28 14:08	38,8 KB
R1-168022.zip	2016/08/28 14:08	216,9 KB
R1-168023.zip	2016/08/28 14:08	201 KB
R1-168024.zip	2016/08/28 14:08	117,4 KB
R1-168025.zip	2016/08/28 14:08	17,3 KB
R1-168026.zip	2016/08/28 14:08	17,3 KB
R1-168028.zip	2016/08/28 14:08	38,3 KB
R1-168029.zip	2016/08/28 14:08	20,1 KB
R1-168030.zip	2016/08/28 14:08	9,6 KB
R1-168031.zip	2016/08/28 14:08	30,5 KB
R1-168032.zip	2016/08/28 14:08	21,1 KB
R1-168033.zip	2016/08/28 14:08	20,8 KB
R1-168035.zip	2016/08/31 16:39	19,6 KB

Petitioners' Exhibit 1007, p. 1603
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168036.zip	2016/08/31 16:40	19,7 KB
R1-168037.zip	2016/08/28 14:08	12 KB
R1-168038.zip	2016/08/28 14:08	65,7 KB
R1-168040.zip	2016/08/28 14:08	68,6 KB
R1-168041.zip	2016/08/28 14:08	373,4 KB
R1-168042.zip	2016/08/28 14:08	120,8 KB
R1-168046.zip	2016/08/28 14:08	59,8 KB
R1-168047.zip	2016/08/28 14:08	36,2 KB
R1-168048.zip	2016/08/28 14:08	49,2 KB
R1-168049.zip	2016/08/28 14:08	49,5 KB
R1-168050.zip	2016/08/28 14:08	24,6 KB
R1-168051.zip	2016/08/28 14:08	44,6 KB
R1-168052.zip	2016/08/28 14:08	30,7 KB
R1-168053.zip	2016/08/28 14:08	61,1 KB
R1-168054.zip	2016/08/28 14:08	49,2 KB
R1-168055.zip	2016/09/01 12:17	49,9 KB
R1-168056.zip	2016/08/28 14:08	36,7 KB
R1-168057.zip	2016/08/28 14:08	36 KB
R1-168058.zip	2016/08/28 14:08	69,2 KB
R1-168059.zip	2016/08/28 14:08	49,5 KB
R1-168060.zip	2016/08/28 14:08	90,4 KB
R1-168061.zip	2016/08/28 14:08	50,8 KB
R1-168062.zip	2016/08/28 14:08	32,9 KB
R1-168063.zip	2016/08/28 14:08	303,2 KB
R1-168064.zip	2016/08/28 14:08	69,5 KB
R1-168065.zip	2016/08/28 14:08	43,8 KB
R1-168066.zip	2016/08/28 14:08	17,7 KB
R1-168067.zip	2016/08/28 14:08	52,7 KB
R1-168068.zip	2016/08/28 14:08	55,7 KB
R1-168069.zip	2016/08/28 14:08	53,6 KB
R1-168070.zip	2016/08/28 14:08	22,9 KB
R1-168071.zip	2016/08/28 14:08	197,1 KB
R1-168072.zip	2016/08/28 14:08	789,7 KB
R1-168073.zip	2016/08/28 14:08	59,2 KB

Petitioners' Exhibit 1007, p. 1604
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sort by name/desc	sort by date/desc	sort by size/desc
R1-168074.zip	2016/08/28 14:08	55,2 KB
R1-168075.zip	2016/08/28 14:08	56,3 KB
R1-168076.zip	2016/08/28 14:08	33,3 KB
R1-168077.zip	2016/08/30 14:13	43,2 KB
R1-168078.zip	2016/08/28 14:08	43,1 KB
R1-168079.zip	2016/08/30 14:16	115,9 KB
R1-168080.zip	2016/08/28 14:08	44,4 KB
R1-168081.zip	2016/08/30 14:13	42,4 KB
R1-168082.zip	2016/08/28 14:08	45,9 KB
R1-168083.zip	2016/08/30 14:16	44,7 KB
R1-168084.zip	2016/08/30 14:16	45,8 KB
R1-168086.zip	2016/08/28 14:08	30 KB
R1-168087.zip	2016/08/31 16:55	48,4 KB
R1-168088.zip	2016/08/28 14:08	32,9 KB
R1-168089.zip	2016/08/28 14:08	12 KB
R1-168090.zip	2016/08/28 14:08	85,2 KB
R1-168091.zip	2016/08/28 14:08	50 KB
R1-168092.zip	2016/08/28 14:08	47 KB
R1-168093.zip	2016/08/28 14:08	29,7 KB
R1-168094.zip	2016/08/28 14:08	32,5 KB
R1-168095.zip	2016/08/28 14:08	118,1 KB
R1-168096.zip	2016/08/28 14:08	62 KB
R1-168097.zip	2016/08/28 14:08	192,3 KB
R1-168098.zip	2016/08/28 14:07	46,1 KB
R1-168099.zip	2016/08/28 14:07	41,6 KB
R1-168100.zip	2016/08/28 14:07	38,7 KB
R1-168101.zip	2016/08/28 14:07	37,7 KB
R1-168103.zip	2016/08/28 14:07	88,6 KB
R1-168104.zip	2016/08/28 14:07	43,2 KB
R1-168105.zip	2016/08/28 14:07	43,5 KB
R1-168106.zip	2016/08/28 14:07	46,1 KB
R1-168107.zip	2016/08/28 14:07	40,1 KB
R1-168108.zip	2016/08/28 14:07	34,2 KB
R1-168109.zip	2016/08/28 14:07	198,2 KB

Petitioners' Exhibit 1007, p. 1605
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168110.zip	2016/08/28 14:07	98,9 KB
R1-168111.zip	2016/08/28 14:07	184,7 KB
R1-168112.zip	2016/08/28 14:07	198,2 KB
R1-168113.zip	2016/08/28 14:07	24,9 KB
R1-168114.zip	2016/08/28 14:07	43,3 KB
R1-168115.zip	2016/08/28 14:07	57,8 KB
R1-168116.zip	2016/08/28 14:07	80,2 KB
R1-168117.zip	2016/08/28 14:07	36,9 KB
R1-168118.zip	2016/08/28 14:07	39,2 KB
R1-168119.zip	2016/08/28 14:07	24,3 KB
R1-168120.zip	2016/08/28 14:07	126 KB
R1-168121.zip	2016/08/28 14:07	44 KB
R1-168122.zip	2016/08/28 14:07	38,1 KB
R1-168123.zip	2016/08/28 14:07	57,2 KB
R1-168124.zip	2016/08/28 14:07	25,2 KB
R1-168125.zip	2016/08/28 14:07	553,6 KB
R1-168126.zip	2016/08/28 14:07	12,1 KB
R1-168127.zip	2016/08/28 14:07	43,8 KB
R1-168128.zip	2016/08/28 14:07	35,8 KB
R1-168129.zip	2016/08/28 14:07	34,4 KB
R1-168130.zip	2016/08/28 14:07	37,3 KB
R1-168131.zip	2016/08/28 14:07	35,2 KB
R1-168132.zip	2016/08/28 14:07	32,5 KB
R1-168134.zip	2016/08/28 14:07	47,3 KB
R1-168135.zip	2016/08/28 14:07	45,9 KB
R1-168136.zip	2016/08/28 14:07	9,2 KB
R1-168137.zip	2016/08/28 14:07	104,7 KB
R1-168138.zip	2016/08/28 14:07	56 KB
R1-168139.zip	2016/08/28 14:07	37,2 KB
R1-168140.zip	2016/08/28 14:07	70,7 KB
R1-168141.zip	2016/08/28 14:07	51,3 KB
R1-168142.zip	2016/08/28 14:07	75,9 KB
R1-168143.zip	2016/08/28 14:07	53,2 KB
R1-168144.zip	2016/08/28 14:07	61,6 KB

Petitioners' Exhibit 1007, p. 1606
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sort by name/desc	sort by date/desc	sort by size/desc
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R1-168147.zip	2016/08/28 14:07	40,7 KB
R1-168148.zip	2016/08/28 14:07	37 KB
R1-168149.zip	2016/08/28 14:07	37,1 KB
R1-168150.zip	2016/08/28 14:07	37 KB
R1-168151.zip	2016/08/28 14:07	132,3 KB
R1-168152.zip	2016/08/28 14:07	52,5 KB
R1-168153.zip	2016/08/28 14:07	73,2 KB
R1-168154.zip	2016/08/28 14:07	50,5 KB
R1-168155.zip	2016/08/28 14:07	29,1 KB
R1-168156.zip	2016/08/28 14:07	29,7 KB
R1-168157.zip	2016/08/28 14:07	29,3 KB
R1-168158.zip	2016/08/28 14:07	27,4 KB
R1-168159.zip	2016/09/02 7:00	18 KB
R1-168160.zip	2016/08/28 14:07	57,7 KB
R1-168161.zip	2016/08/28 14:07	29,5 KB
R1-168162.zip	2016/08/28 14:07	61,2 KB
R1-168163.zip	2016/08/28 14:07	174,2 KB
R1-168164.zip	2016/08/28 14:07	42,6 KB
R1-168165.zip	2016/08/28 14:07	36,2 KB
R1-168166.zip	2016/08/28 14:07	35,8 KB
R1-168167.zip	2016/08/28 14:07	51,4 KB
R1-168168.zip	2016/08/28 14:07	82,1 KB
R1-168169.zip	2016/08/28 14:07	43,5 KB
R1-168170.zip	2016/08/28 14:07	45,6 KB
R1-168171.zip	2016/08/28 14:07	46,5 KB
R1-168172.zip	2016/08/28 14:07	126,4 KB
R1-168173.zip	2016/08/28 14:07	51,9 KB
R1-168174.zip	2016/08/28 14:07	57,3 KB
R1-168175.zip	2016/08/28 14:06	33 KB
R1-168176.zip	2016/08/28 14:06	56,4 KB
R1-168177.zip	2016/08/28 14:06	52,2 KB
R1-168178.zip	2016/08/28 14:06	43,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-168179.zip	2016/08/28 14:06	58,3 KB
R1-168180.zip	2016/08/28 14:06	55,2 KB
R1-168181.zip	2016/08/28 14:06	41,1 KB
R1-168182.zip	2016/08/28 14:06	41,7 KB
R1-168184.zip	2016/08/28 14:06	31,4 KB
R1-168185.zip	2016/08/28 14:06	113,3 KB
R1-168186.zip	2016/08/28 14:06	49,5 KB
R1-168187.zip	2016/08/28 14:06	63,9 KB
R1-168188.zip	2016/08/28 14:06	51,6 KB
R1-168189.zip	2016/08/28 14:06	38,6 KB
R1-168191.zip	2016/08/28 14:06	103,6 KB
R1-168192.zip	2016/08/28 14:06	36,2 KB
R1-168193.zip	2016/08/28 14:06	53,4 KB
R1-168194.zip	2016/08/28 14:06	65 KB
R1-168195.zip	2016/08/28 14:06	47,1 KB
R1-168196.zip	2016/08/28 14:06	42,8 KB
R1-168197.zip	2016/08/28 14:06	208,9 KB
R1-168198.zip	2016/08/28 14:06	15,7 KB
R1-168199.zip	2016/08/28 14:06	27,4 KB
R1-168200.zip	2016/08/28 14:06	20,1 KB
R1-168201.zip	2016/08/28 14:06	20,4 KB
R1-168202.zip	2016/08/28 14:06	31,2 KB
R1-168211.zip	2016/09/02 7:01	2179,8 KB
R1-168212.zip	2016/09/02 7:01	28,9 KB
R1-168213.zip	2016/09/02 13:54	33,6 KB
R1-168214.zip	2016/09/02 12:02	16,8 KB
R1-168215.zip	2016/09/08 13:52	5548,6 KB
R1-168216.zip	2016/09/08 13:52	170,2 KB
R1-168217.zip	2016/09/06 7:38	132,7 KB
R1-168218.zip	2016/09/08 13:52	28,5 KB
R1-168219.zip	2016/09/06 13:26	49 KB
R1-168220.zip	2016/09/16 9:29	2972,6 KB
R1-168221.zip	2016/09/16 9:28	167 KB
R1-168222.zip	2016/09/14 9:19	792,3 KB

Petitioners' Exhibit 1007, p. 1608
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168223.zip	2016/09/13 13:36	170,6 KB
R1-168224.zip	2016/09/13 13:36	95,9 KB
R1-168225.zip	2016/09/14 9:19	213,6 KB
R1-168226.zip	2016/09/13 14:18	296,2 KB
R1-168227.zip	2016/09/13 13:36	28,6 KB
R1-168228.zip	2016/09/13 14:18	2179 KB
R1-168229.zip	2016/09/14 9:19	33 KB
R1-168230.zip	2016/08/28 14:06	40,7 KB
R1-168231.zip	2016/08/28 14:06	39,9 KB
R1-168232.zip	2016/08/28 14:06	93,4 KB
R1-168233.zip	2016/08/28 14:06	41,8 KB
R1-168234.zip	2016/08/28 14:06	210 KB
R1-168235.zip	2016/08/28 14:06	34 KB
R1-168236.zip	2016/08/28 14:06	520,6 KB
R1-168237.zip	2016/08/28 14:06	35,4 KB
R1-168238.zip	2016/08/28 14:06	25,5 KB
R1-168239.zip	2016/08/28 14:06	57,8 KB
R1-168240.zip	2016/08/28 14:06	116,3 KB
R1-168241.zip	2016/08/28 14:06	32,3 KB
R1-168242.zip	2016/08/28 14:06	30,1 KB
R1-168243.zip	2016/08/28 14:06	39,1 KB
R1-168244.zip	2016/08/28 14:06	14,4 KB
R1-168245.zip	2016/08/28 14:06	21,5 KB
R1-168246.zip	2016/08/28 14:06	29,8 KB
R1-168247.zip	2016/08/28 14:06	36,4 KB
R1-168248.zip	2016/08/28 14:06	287,5 KB
R1-168249.zip	2016/08/28 14:06	22,8 KB
R1-168250.zip	2016/08/28 14:06	14,5 KB
R1-168251.zip	2016/08/28 14:06	22,8 KB
R1-168252.zip	2016/08/28 14:06	30,4 KB
R1-168253.zip	2016/08/28 14:06	116,1 KB
R1-168254.zip	2016/08/28 14:06	52,3 KB
R1-168255.zip	2016/08/28 14:06	61,5 KB
R1-168256.zip	2016/08/28 14:06	9,2 KB

Petitioners' Exhibit 1007, p. 1609
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168257.zip	2016/08/28 14:06	56,9 KB
R1-168258.zip	2016/08/28 14:06	13,8 KB
R1-168260.zip	2016/08/28 14:06	26 KB
R1-168261.zip	2016/08/28 14:06	52,4 KB
R1-168263.zip	2016/08/28 14:06	15,7 KB
R1-168264.zip	2016/08/28 14:06	38,2 KB
R1-168265.zip	2016/08/28 14:06	90,7 KB
R1-168266.zip	2016/08/28 14:06	37,2 KB
R1-168267.zip	2016/08/28 14:06	561,5 KB
R1-168268.zip	2016/08/28 14:06	36,8 KB
R1-168269.zip	2016/08/28 14:06	39,2 KB
R1-168271.zip	2016/08/28 14:06	306,8 KB
R1-168272.zip	2016/08/28 14:05	56,9 KB
R1-168273.zip	2016/08/28 14:05	102,1 KB
R1-168274.zip	2016/08/28 14:05	104,5 KB
R1-168275.zip	2016/08/28 14:05	40,9 KB
R1-168276.zip	2016/08/28 14:05	42,1 KB
R1-168277.zip	2016/08/28 14:05	26,3 KB
R1-168278.zip	2016/08/28 14:05	24,4 KB
R1-168279.zip	2016/08/28 14:05	38,7 KB
R1-168280.zip	2016/08/28 14:05	50 KB
R1-168281.zip	2016/08/28 14:05	40,5 KB
R1-168282.zip	2016/08/28 14:05	43,7 KB
R1-168283.zip	2016/08/28 14:05	52,3 KB
R1-168284.zip	2016/08/28 14:05	51,5 KB
R1-168285.zip	2016/08/28 14:05	49,5 KB
R1-168286.zip	2016/08/28 14:05	46 KB
R1-168287.zip	2016/08/28 14:05	30,2 KB
R1-168288.zip	2016/08/28 14:05	78,2 KB
R1-168289.zip	2016/08/28 14:05	81 KB
R1-168290.zip	2016/08/28 14:05	112,6 KB
R1-168291.zip	2016/08/28 14:05	44 KB
R1-168292.zip	2016/08/28 14:05	45,2 KB
R1-168293.zip	2016/08/28 14:05	32,3 KB

Petitioners' Exhibit 1007, p. 1610
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168294.zip	2016/08/28 14:05	88,8 KB
R1-168295.zip	2016/08/28 14:05	19,9 KB
R1-168296.zip	2016/08/28 14:05	27,5 KB
R1-168297.zip	2016/08/28 14:05	102,3 KB
R1-168298.zip	2016/08/28 14:05	87,6 KB
R1-168299.zip	2016/08/28 14:05	50,6 KB
R1-168300.zip	2016/08/28 14:05	19,9 KB
R1-168301.zip	2016/08/28 14:05	54,6 KB
R1-168302.zip	2016/08/28 14:05	43,4 KB
R1-168304.zip	2016/08/28 14:05	37,7 KB
R1-168305.zip	2016/08/28 14:05	86,2 KB
R1-168306.zip	2016/08/28 14:05	25 KB
R1-168307.zip	2016/08/28 14:05	61,1 KB
R1-168308.zip	2016/08/28 14:05	49,2 KB
R1-168309.zip	2016/08/28 14:05	184,7 KB
R1-168310.zip	2016/08/28 14:05	34,5 KB
R1-168311.zip	2016/08/28 14:05	25,6 KB
R1-168312.zip	2016/08/28 14:05	45 KB
R1-168313.zip	2016/08/28 14:05	26,6 KB
R1-168314.zip	2016/08/28 14:05	28,7 KB
R1-168315.zip	2016/08/28 14:05	28,7 KB
R1-168316.zip	2016/08/28 14:05	94,2 KB
R1-168317.zip	2016/08/28 14:05	53,3 KB
R1-168318.zip	2016/08/28 14:05	99,1 KB
R1-168319.zip	2016/08/28 14:05	29,3 KB
R1-168321.zip	2016/08/28 14:05	79,9 KB
R1-168322.zip	2016/08/28 14:05	40,6 KB
R1-168323.zip	2016/08/28 14:05	38,1 KB
R1-168325.zip	2016/08/28 14:05	54,1 KB
R1-168326.zip	2016/08/28 14:05	53,2 KB
R1-168328.zip	2016/08/28 14:05	32 KB
R1-168329.zip	2016/08/28 14:05	411,7 KB
R1-168330.zip	2016/08/28 14:05	24,9 KB
R1-168331.zip	2016/08/28 14:05	103,7 KB

Petitioners' Exhibit 1007, p. 1611
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168332.zip	2016/08/28 14:05	40,6 KB
R1-168333.zip	2016/08/28 14:05	30,9 KB
R1-168334.zip	2016/08/28 14:05	31,5 KB
R1-168335.zip	2016/08/28 14:05	13,8 KB
R1-168336.zip	2016/08/28 14:05	53,1 KB
R1-168337.zip	2016/08/28 14:05	484,2 KB
R1-168338.zip	2016/08/28 14:05	65,4 KB
R1-168339.zip	2016/08/28 14:05	41,3 KB
R1-168340.zip	2016/08/28 14:05	16 KB
R1-168341.zip	2016/08/28 14:05	54,7 KB
R1-168342.zip	2016/08/28 14:05	39,5 KB
R1-168343.zip	2016/08/28 14:05	46,6 KB
R1-168344.zip	2016/08/28 14:05	40,4 KB
R1-168345.zip	2016/08/28 14:05	54 KB
R1-168346.zip	2016/08/28 14:05	54,6 KB
R1-168347.zip	2016/08/28 14:05	46,7 KB
R1-168348.zip	2016/08/28 14:05	185 KB
R1-168349.zip	2016/08/28 14:04	45,6 KB
R1-168350.zip	2016/08/28 14:04	58,1 KB
R1-168351.zip	2016/08/28 14:04	68,7 KB
R1-168352.zip	2016/08/28 14:04	37,7 KB
R1-168353.zip	2016/08/28 14:04	136,6 KB
R1-168354.zip	2016/08/28 14:04	107,3 KB
R1-168355.zip	2016/08/28 14:04	31,4 KB
R1-168356.zip	2016/08/28 14:04	86,4 KB
R1-168357.zip	2016/08/28 14:04	22,1 KB
R1-168358.zip	2016/08/28 14:04	41,6 KB
R1-168359.zip	2016/08/28 14:04	42,7 KB
R1-168360.zip	2016/08/28 14:04	58 KB
R1-168361.zip	2016/08/28 14:04	45,6 KB
R1-168362.zip	2016/08/28 14:04	19,6 KB
R1-168363.zip	2016/08/28 14:04	34,4 KB
R1-168364.zip	2016/08/28 14:04	45,3 KB
R1-168365.zip	2016/08/28 14:04	19,7 KB

Petitioners' Exhibit 1007, p. 1612
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168366.zip	2016/08/28 14:04	40 KB
R1-168367.zip	2016/08/28 14:04	57,5 KB
R1-168368.zip	2016/08/28 14:04	48,3 KB
R1-168369.zip	2016/08/28 14:04	47,7 KB
R1-168370.zip	2016/08/28 14:04	216,8 KB
R1-168371.zip	2016/08/28 14:04	64,7 KB
R1-168372.zip	2016/08/28 14:04	51,2 KB
R1-168373.zip	2016/08/28 14:04	123,4 KB
R1-168374.zip	2016/08/28 14:04	29,3 KB
R1-168375.zip	2016/08/28 14:04	32,5 KB
R1-168376.zip	2016/08/28 14:04	37,1 KB
R1-168377.zip	2016/08/28 14:04	45 KB
R1-168378.zip	2016/08/28 14:04	92,8 KB
R1-168379.zip	2016/08/28 14:04	34,8 KB
R1-168380.zip	2016/08/28 14:04	37,6 KB
R1-168381.zip	2016/08/28 14:04	35,1 KB
R1-168382.zip	2016/08/28 14:04	199,1 KB
R1-168383.zip	2016/08/28 14:04	37,6 KB
R1-168384.zip	2016/08/28 14:04	92 KB
R1-168385.zip	2016/08/28 14:04	44,5 KB
R1-168386.zip	2016/08/28 14:04	109 KB
R1-168387.zip	2016/08/28 14:04	105,9 KB
R1-168388.zip	2016/08/28 14:04	135,7 KB
R1-168389.zip	2016/08/28 14:04	106,3 KB
R1-168390.zip	2016/08/28 14:04	28,2 KB
R1-168391.zip	2016/08/28 14:04	555,4 KB
R1-168392.zip	2016/08/28 14:04	56,4 KB
R1-168393.zip	2016/08/28 14:04	52,9 KB
R1-168394.zip	2016/08/28 14:04	35,3 KB
R1-168395.zip	2016/08/28 14:04	44,8 KB
R1-168396.zip	2016/08/28 14:04	38,1 KB
R1-168397.zip	2016/08/28 14:04	51,1 KB
R1-168398.zip	2016/08/28 14:04	36,3 KB
R1-168399.zip	2016/08/28 14:04	41,7 KB

Petitioners' Exhibit 1007, p. 1613
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-168400.zip	2016/08/28 14:04	99,4 KB
R1-168401.zip	2016/08/28 14:04	95,8 KB
R1-168402.zip	2016/08/28 14:04	92,3 KB
R1-168403.zip	2016/08/28 14:04	135 KB
R1-168404.zip	2016/08/28 14:04	93,5 KB
R1-168405.zip	2016/08/28 14:04	108,7 KB
R1-168406.zip	2016/08/28 14:04	97,7 KB
R1-168407.zip	2016/08/28 14:04	91,8 KB
R1-168408.zip	2016/08/28 14:04	91,6 KB
R1-168409.zip	2016/08/28 14:04	90,5 KB
R1-168410.zip	2016/08/28 14:04	122,6 KB
R1-168411.zip	2016/08/28 14:04	96 KB
R1-168412.zip	2016/08/28 14:04	102 KB
R1-168413.zip	2016/08/28 14:04	101,2 KB
R1-168414.zip	2016/08/28 14:04	89,2 KB
R1-168415.zip	2016/08/28 14:03	18,6 KB
R1-168416.zip	2016/08/28 14:03	87,6 KB
R1-168417.zip	2016/08/28 14:03	214,5 KB
R1-168418.zip	2016/08/28 14:03	99,7 KB
R1-168419.zip	2016/08/28 14:03	104,2 KB
R1-168420.zip	2016/08/28 14:03	99,6 KB
R1-168421.zip	2016/08/28 14:03	138,8 KB
R1-168422.zip	2016/08/28 14:03	57,5 KB
R1-168423.zip	2016/08/28 14:03	71,9 KB
R1-168424.zip	2016/08/28 14:03	38,1 KB
R1-168425.zip	2016/08/28 14:03	52,8 KB
R1-168426.zip	2016/08/28 14:03	59,4 KB
R1-168427.zip	2016/08/28 14:03	76,6 KB
R1-168428.zip	2016/08/28 14:03	55,4 KB
R1-168429.zip	2016/08/28 14:03	312,4 KB
R1-168430.zip	2016/08/28 14:03	47,1 KB
R1-168431.zip	2016/08/28 14:03	102,3 KB
R1-168432.zip	2016/08/28 14:03	21 KB
R1-168433.zip	2016/08/28 14:03	21,6 KB

Petitioners' Exhibit 1007, p. 1614
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sort by name/desc	sort by date/desc	sort by size/desc
R1-168434.zip	2016/08/28 14:03	48,6 KB
R1-168435.zip	2016/08/28 14:03	62,4 KB
R1-168436.zip	2016/08/28 14:03	58,6 KB
R1-168437.zip	2016/08/28 14:03	31,3 KB
R1-168438.zip	2016/08/28 14:03	35 KB
R1-168439.zip	2016/08/28 14:03	58,5 KB
R1-168440.zip	2016/08/28 14:03	69,7 KB
R1-168441.zip	2016/08/28 14:03	33,7 KB
R1-168442.zip	2016/08/28 14:03	49,9 KB
R1-168444.zip	2016/08/28 14:03	27,4 KB
R1-168445.zip	2016/08/28 14:03	92,8 KB
R1-168446.zip	2016/08/28 14:03	49,7 KB
R1-168447.zip	2016/08/28 14:03	20,9 KB
R1-168448.zip	2016/08/28 14:03	103,7 KB
R1-168449.zip	2016/08/28 14:03	46 KB
R1-168450.zip	2016/08/28 14:03	58 KB
R1-168451.zip	2016/08/28 14:03	38,2 KB
R1-168452.zip	2016/08/28 14:03	29,5 KB
R1-168453.zip	2016/08/28 14:03	64,7 KB
R1-168454.zip	2016/08/28 14:03	44,4 KB
R1-168455.zip	2016/08/28 14:03	35,3 KB
R1-168457.zip	2016/09/14 9:19	19,1 KB
R1-168458.zip	2016/08/28 14:03	20,4 KB
R1-168459.zip	2016/08/28 14:03	21 KB
R1-168460.zip	2016/08/28 14:03	21,6 KB
R1-168461.zip	2016/08/28 14:03	38,2 KB
R1-168462.zip	2016/08/28 14:03	29,7 KB
R1-168463.zip	2016/08/28 14:03	38,7 KB
R1-168464.zip	2016/08/28 14:03	53 KB
R1-168465.zip	2016/08/28 14:03	39,6 KB
R1-168466.zip	2016/08/28 14:03	27,7 KB
R1-168467.zip	2016/08/28 14:03	34,7 KB
R1-168468.zip	2016/08/28 14:03	41,2 KB
R1-168469.zip	2016/08/28 14:03	41,9 KB

Petitioners' Exhibit 1007, p. 1615
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sort by name/desc	sort by date/desc	sort by size/desc
R1-168470.zip	2016/08/28 14:03	17,3 KB
R1-168471.zip	2016/08/28 14:03	46,4 KB
R1-168472.zip	2016/08/28 14:03	24,8 KB
R1-168473.zip	2016/08/28 14:03	109,6 KB
R1-168474.zip	2016/08/28 14:03	14 KB
R1-168475.zip	2016/08/28 14:03	40,1 KB
R1-168476.zip	2016/08/28 14:03	56,2 KB
R1-168477.zip	2016/08/28 14:03	18,8 KB
R1-168478.zip	2016/08/28 14:03	17,7 KB
R1-168479.zip	2016/08/28 14:03	22,4 KB
R1-168480.zip	2016/08/28 14:03	56,1 KB
R1-168481.zip	2016/08/28 14:03	41,2 KB
R1-168482.zip	2016/08/28 14:03	44,2 KB
R1-168483.zip	2016/08/28 14:03	52,8 KB
R1-168484.zip	2016/08/28 14:03	96 KB
R1-168485.zip	2016/08/28 14:03	22,1 KB
R1-168486.zip	2016/08/28 14:03	43 KB
R1-168487.zip	2016/08/28 14:03	116,7 KB
R1-168488.zip	2016/08/28 14:03	54,8 KB
R1-168489.zip	2016/08/28 14:03	31,6 KB
R1-168491.zip	2016/08/28 14:03	38,3 KB
R1-168492.zip	2016/08/28 14:03	28,2 KB
R1-168493.zip	2016/08/28 14:03	62,1 KB
R1-168494.zip	2016/08/28 14:03	40,3 KB
R1-168495.zip	2016/08/28 14:03	127,4 KB
R1-168496.zip	2016/08/28 14:03	36,5 KB
R1-168497.zip	2016/08/28 14:03	13,9 KB
R1-168498.zip	2016/08/28 14:03	54,5 KB
R1-168499.zip	2016/08/28 14:02	103,2 KB
R1-168500.zip	2016/08/28 14:02	43,9 KB
R1-168501.zip	2016/08/28 14:02	40,3 KB
R1-168502.zip	2016/08/28 14:02	34,4 KB
R1-168503.zip	2016/08/28 14:02	100,9 KB
R1-168504.zip	2016/08/28 14:02	46,3 KB

Petitioners' Exhibit 1007, p. 1616
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sort by name/desc	sort by date/desc	sort by size/desc
R1-168505.zip	2016/08/28 14:02	26,5 KB
R1-168506.zip	2016/08/28 14:02	46,6 KB
R1-168507.zip	2016/08/28 14:02	49,5 KB
R1-168508.zip	2016/08/28 14:02	32,1 KB
R1-168509.zip	2016/08/28 14:02	39,6 KB
R1-168510.zip	2016/08/28 14:02	57,9 KB
R1-168511.zip	2016/08/28 14:02	47,5 KB
R1-168512.zip	2016/08/28 14:02	38,6 KB
R1-168513.zip	2016/08/28 14:02	53,6 KB
R1-168514.zip	2016/08/28 14:02	60,7 KB
R1-168515.zip	2016/08/28 14:02	89,1 KB
R1-168516.zip	2016/08/28 14:02	25,5 KB
R1-168517.zip	2016/08/28 14:02	161,2 KB
R1-168518.zip	2016/08/28 14:02	65,4 KB
R1-168519.zip	2016/08/28 14:02	78,3 KB
R1-168520.zip	2016/08/28 14:02	67 KB
R1-168521.zip	2016/08/28 14:02	32,3 KB
R1-168522.zip	2016/08/28 14:02	41 KB
R1-168523.zip	2016/08/28 14:02	282,2 KB
R1-168524.zip	2016/08/28 14:02	192,3 KB
R1-168525.zip	2016/08/28 14:02	43,4 KB
R1-168526.zip	2016/08/28 14:02	272 KB
R1-168527.zip	2016/08/28 14:02	16,1 KB
R1-168528.zip	2016/08/28 14:02	16,1 KB
R1-168529.zip	2016/08/28 14:02	111 KB
R1-168530.zip	2016/08/28 14:02	27,7 KB
R1-168531.zip	2016/08/28 14:02	30,5 KB
R1-168532.zip	2016/08/28 14:02	28,3 KB
R1-168533.zip	2016/08/28 14:02	79,5 KB
R1-168534.zip	2016/08/28 14:02	52 KB
R1-168535.zip	2016/08/28 14:02	26,8 KB
R1-168536.zip	2016/08/28 14:02	54,3 KB
R1-168537.zip	2016/08/28 14:02	84,5 KB
R1-168538.zip	2016/08/28 14:02	59,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-168539.zip	2016/08/28 14:02	25,5 KB
R1-168540.zip	2016/08/28 14:02	46,3 KB
R1-168541.zip	2016/08/28 14:02	41,8 KB
R1-168542.zip	2016/08/28 14:02	167,8 KB
R1-168543.zip	2016/08/28 14:02	38,1 KB
R1-168544.zip	2016/08/28 14:02	230,9 KB
R1-168545.zip	2016/08/28 14:02	34,5 KB
R1-168546.zip	2016/08/28 14:02	28 KB
R1-168547.zip	2016/08/28 14:02	555,2 KB
R1-168548.zip	2016/08/28 14:02	71,9 KB
R1-168549.zip	2016/08/28 14:02	116,5 KB
R1-168550.zip	2016/08/28 14:02	45,4 KB
R1-168551.zip	2016/08/28 14:02	39,6 KB
R1-168552.zip	2016/08/28 14:02	25,5 KB
R1-168553.zip	2016/08/28 14:02	25,3 KB
R1-168554.zip	2016/08/28 14:02	19,6 KB
R1-168555.zip	2016/08/28 14:02	28 KB
R1-168556.zip	2016/08/28 14:02	17,2 KB
R1-168557.zip	2016/08/28 14:02	20,6 KB
R1-168558.zip	2016/08/28 14:02	27,7 KB
R1-168559.zip	2016/08/28 14:02	38,2 KB
R1-168560.zip	2016/09/21 7:20	171,5 KB
TDoc_List_Meeting_RAN1#86.xlsm	2017/01/16 0:32	582,4 KB
TDoc_List_Meeting_RAN1#86.xlsx	2022/01/10 15:30	573,6 KB
TDoc_List_Meeting_RAN1#86.zip	2018/01/10 16:44	1046,7 KB

2435 items.

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APPENDIX 31

3GPP_TSG_RAN_WG1 Archives
September 2016, Week 1

3GPP_TSG_RAN_WG1@LIST.ETSI.ORG

Options: Use Monospaced Font
Show Text Part by Default
Show All Mail Headers

Message: [<< First] [< Prev] [Next >] [Last >>]
Topic: [<< First] [< Prev] [Next >] [Last >>]
Author: [<< First] [< Prev] [Next >] [Last >>]

Subject: [RAN1#86]: Meeting report
From: Patrick Merias <[log in to unmask]>
Reply To: Patrick Merias <[log in to unmask]>
Date: Sat, 3 Sep 2016 08:50:38 +0000
Content-Type: multipart/mixed
Parts/Attachments: text/plain (1090 bytes) , text/html (4 kB) ,
Draft_Minutes_report_RAN1#86_v010.zip (765 kB)

Dear all,

RAN1#86 Tdoc_list has finally been successfully uploaded to 3GU last night – you may, if needed, download it from the portal…
I've not checked all AIs yet. So all statuses are not properly reflected but I will work on that ☺
All maintenance CRs should be ok – as I'm also preparing RAN1 inputs to next plenary, full list of the agreed CRs should soon be available but I'm currently checking CRs to 38.900 (AI 8.2) – I'll distribute it to the reflector when ready
Very first draft of the minutes is attached
BR/P

Patrick Merias– Mobile Competence Center Technical Officer
ETSI • www.etsi.org • [log in to unmask]
Phone: +33 (0)4 92 94 42 06 • Mobile: +33 (0)6 07 59 08 47
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ATOM RSS1 RSS2

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APPENDIX 32

Source: MCC Support

Title: Draft Report of 3GPP TSG RAN WG1 #86 v0.1.0 (Gothenburg, Sweden, 22nd – 26th August 2016)

Document for: Comments



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Main facts summary

3GPP TSG WG RAN1 #86 meeting, hosted by the European Friends of 3GPP, was held at the Gothia Towers Hotel, Gothenburg, Sweden.
The meeting started at 9:00 on Monday 22nd August and finished at 17:00 on Friday 26th August 2016.
The number of attending delegates, having confirmed their participation through the electronic check-in application, was **422.**
Note that the number of registered was a kind of record and reached 599.

The schedule of the week was as follows:

- Monday: Common session on Agenda items 1, 2, 3, 4, 5, 7.1.2 (Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers), 7.1.3 (Maintenance of Release 13 LAA) and 7.1.4 (Maintenance of Release 13 EB/FD-MIMO) followed by Study on Latency reduction techniques (AI 7.3.10.1 on Evaluation results, AI 7.3.10.2 on Channel design for shortened TTI)
- Monday afternoon (LTE)
  - Session on NB-IoT (AI 7.2.1) chaired by Matthew Baker.

- Tuesday (NR): chaired by Satoshi Nagata
- Tuesday (LTE session1): chaired by Matthew Baker
  - eMBMS enhancements for LTE (AI 7.3.5), SRS Carrier Based Switching for LTE (AI 7.3.6) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Tuesday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (and possibly other CRs (e.g., LAA, MIMO, eCA), Further Indoor Positioning enhancements for UTRA and LTE (AI 7.3.7), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Tuesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Tuesday (HSPA): Multi-Carrier enhancements for UMTS (AI 6.2) chaired by Carmela Cozzo from Huawei.

- Wednesday (NR): chaired by Satoshi Nagata
- Wednesday (LTE session1): chaired by Matthew Baker
  - Rel-13 CRs Maintenance (AI 7.1), Uplink Capacity Enhancements for LTE (AI 7.3.8), Study on Latency reduction techniques (AI 7.3.10) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Wednesday (LTE session2): chaired by Wanshi Chen
  - Support for V2V services based on LTE sidelink (AI 7.3.2), Study on LTE-based V2X Services (AI 7.3.9) and Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1).
- Wednesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Wednesday (HSPA): DTX/DRX enhancements in CELL_FACH (AI 6.3) chaired by Florent Munier from Ericsson followed by Maintenance.

- Thursday (NR): chaired by Satoshi Nagata
- Thursday (LTE session1): chaired by Matthew Baker
  - Rel-13 CRs Maintenance (AI 7.1), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1), Study on Latency reduction techniques (AI 7.3.10), Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3) and Downlink Multiuser Superposition Transmission for LTE (AI 7.3.4).
- Thursday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (AI 7.1.5), Downlink Multiuser Superposition Transmission for LTE (AI 7.3.4), Study on LTE-based V2X Services (AI 7.3.9), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Thursday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia and session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.

- Friday: Revisions. Continued offline in the morning (eLAA,…).

The list of action points that required RAN1 close follow-up is listed in Annex F (end of document).

The number of contribution documents for this meeting was xxxx, and those documents were categorized as followed.

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Agenda Item	Input Document	Treated Document
All		

Note: The amount of documents includes those discussed during the email discussion session post meeting.

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1 Opening of the meeting

Mr Satoshi Nagata (RAN1 Chairman) welcomed the participants of the RAN WG1 86 meeting and opened the meeting at 09:00. Mr Johan Bergman from Ericsson welcomed the delegates on behalf of the European Friends of 3GPP, Alcatel-Lucent, Apple, BlackBerry, Deutsche Telekom, Ericsson, Huawei, Intel, KPN, Motorola, Nokia, Orange, Qualcomm, SIMAlliance, Sony, TeliaSonera, Telefonica, TIM, Telenor, Vodafone and detailed the domestic arrangements for the full week.

1.1 Call for IPR

The attention of the members of this Technical Specification Group was drawn to the fact ***that 3GPP Individual Members have the obligation*** *under the IPR Policies of their respective Organizational Partners to* ***inform their respective*** *Organizational Partners* ***of Essential IPRs they become aware of****.*
The members take note that they are hereby invited:

- *to investigate whether their organization or any other organization owns IPRs which were, or were likely to become Essential in respect of the work of 3GPP.*
- *to notify their respective Organizational Partners of all potential IPRs, e.g., for ETSI, by means of the IPR Information Statement and the Licensing declaration forms (e.g. see the ETSI IPR forms http://webapp.etsi.org/Ipr/).*

1.2 Competition law statement

The Chairman also drew Member's attention to the fact that 3GPP activities are subject to antitrust and competition laws and that compliance with said laws is therefore required of any participant of this WG meeting including the Chairman and Vice Chairmen. In case of question, please contact your legal counsel.
The present meeting will be conducted with strict impartiality and in the interests of 3GPP.
Furthermore, the Chairman reminded Members that timely submission of work items/contributions in advance of WG meetings is important to allow for full and fair consideration of such matters.

1.3 Network usage conditions

The PCG has laid down the following network usage conditions:

Users shall not use the network to engage in illegal activities. This includes activities such as copyright violation, hacking, espionage or any other activity that may be prohibited by local laws.

Users shall not engage in non-work related activities that consume excessive bandwidth or cause significant degradation of the performance of the network.
Since the **network is a shared resource**, users should exercise some basic etiquette when using the 3GPP network at a meeting. It is understood that high bandwidth applications such as downloading large files or video streaming might be required for business purposes, but delegates should be strongly discouraged in performing these activities for personal use. Downloading a movie or doing something in an interactive environment for personal use essentially wastes bandwidth that others need to make the meeting effective. The meeting chairman should remind end users that the network is a shared resource; the more one user grabs, the less there is for another. Email and its attachments already take up significant bandwidth (certain email programs are not very bandwidth efficient). In case of need the chair can ask the delegates to restrict IT usage to things that are essential for the meeting itself.

1. DON'T place your WiFi device in ad-hoc mode
2. DON'T set up a personal hotspot in the meeting room
3. DO try 802.11a if your WiFi device supports it
4. DON'T manually allocate an IP address
5. DON'T be a bandwidth hog by streaming video, playing online games, or downloading huge files
6. DON'T use packet probing software which clogs the local network (e.g., packet sniffers or port scanners)

2 Approval of Agenda

R1-166055 **Draft Agenda of RAN1#86 meeting** **RAN1 Chair**
Satoshi Nagata (Chairman) proposed the agenda for the meeting, as well the schedule of the week.
Discussion: No comment.
Decision: The agenda is approved.

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3 Approval of Minutes from previous meeting

R1-166056 Final Report of 3GPP TSG RAN1 #85 v1.0.0 ETSI

The document was presented by Patrick Mérias (ETSI Mobile Competence Center) and provides the outcomes of last meeting in China.

Discussion: MCC→ due to the inflation of contributions (>1800 at meeting start), RAN1 will shortly burst the 9999 tdocs per year barrier (4 digits upper limit) – RAN1 was warned that 5 digits numbering might be introduced at the next meeting.
MCC→ rapporteurs of WI/SI chairing sessions during the week are requested to highlight and use the bold type to clearly show the treated contributions in their notes and help MCC recording correct statuses in 3GU.

Decision: The document is approved.

4 Highlights from RAN Plenary

R1-166057 Selected highlights from RAN#72 of relevance to RAN1 RAN1 Chair

The document was presented by RAN1 Chair and feedbacks the decisions made by RAN#72, relevant to RAN1.

Discussion: Chair → regarding the additional ad-hoc meetings for NR, current view is as follows:

- January 2017 – 5days meeting – likely in the US (exact location still to be defined)
- June 2017 – 4days meeting – likely in Asia (Japan, India)

Decision: The document is noted.

5 Incoming Liaison Statements

R1-166073 LS to RAN1 on clarification on MIMO capability RAN2, Huawei

The document was presented by Xia Yuan from Huawei and raises an IOT issue if UE and network have different understanding in the case where, for instance the UE supports following two combinations simultaneously:

Combination 1: Band A 4*4 layers; Band B 2*2 layers
Combination 2: Band A 2*2 layers; Band B 4*4 layers;

How can the UE to determine the maximum number of layers for RI bit and Kc? 4*4 layers for band A or 2*2 layers for band A?

Decision: The document is noted.

R1-167906 Reply LS for clarification on MIMO capability Huawei

Discussion: .Qualcomm confirmed solution 2 is the preferred one. Potential UE capability discussion may be needed in RAN2.

Decision: The document is noted and final LS is agreed in R1-167914.

R1-166086 LS on 256QAM support for UE Category 9/10 from Rel-12 RAN, Intel

The document was presented by Seunghee Lee from Intel and asks to create the CRs reflecting that:

- For a Rel-12 UE supporting all UE radio access capability parameters for both Cat.9/10 and Cat.13,
  - The UE can report both Cat.9/10 and Cat.13
    - The eNB may understand that the UE supports all UE radio access capability parameters of both Cat.9/10 and Cat.13
      - Therefore either category can be applied individually (but not a combination of parameters of different categories)

Decision: The document is noted.

R1-166192 Discussion on UE reporting both category 9/10 and 13 Huawei, HiSilicon

The document was presented by Xia Yuan from Huawei.

- Proposal: DL UE category 13 could indicate category 9 or 10 if supported

Decision: The document is noted.

R1-166500 Discussion on simultaneous signaling of categories 9/10 and 13 Intel Corporation

The document was presented by Alexei from Davydov and proposes the following principles for deriving rate matching parameters and storing the received soft channel bits for such UEs are as follows:

- No specification change is required for the rate matching procedure in TS 36.212 to support UE simultaneously indicating support of category 9/10 and 13
- To support UE simultaneously indicating support of category 9/10 and 13 the Nsoft for sorting the received soft channel bits in TS 36.213 should be based on UE category 9/10 rather than DL category 13.

Discussion: Qualcomm → not aligned with RAN's agreement

Decision: The document is noted.

R1-167191 Introduction of simultaneous signalling of categories 9/10 and 13 Intel Corporation
R1-167192 Introduction of simultaneous signalling of categories 9/10 and 13 Intel Corporation

Agreements:

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- No specification change is required for the rate matching procedure in TS 36.212 to support UE simultaneously indicating support of category 9/10 and 13
- For TS 36.213, N'_{soft} is the maximum "Total number of soft channel bits" [12] among all the indicated UE categories [11] of this UE.

R1-167398 Correction on storing soft channel bits for different UE categories Huawei, HiSilicon, NTT DOCOMO, SoftBank

- Change the soft channel bits assumption to be suitable for all the UE categories in TS36.213 so that the total number of soft channel bits is based on the maximum "Total number of soft channel bits" of all the UE categories supported by this UE.

Decision: The document is noted and CR0704 to 36.213 is not pursued.

Following LS was received during RAN1#86:

R1-168520 LS on Support of CAT 9/10 and CAT 13 RAN2

RAN2 agrees to use existing IEs i.e the UE indicates both ue-Category-v1170 (= Category 9/10) and ue-CategoryDL-r12 (= Category 13) when it supports both Category 9/10 and Category 13. RAN2 confirms that there is no backward compatibility issue when the UE sends both UE category IEs. Furthermore, the corresponding Rel-12/13 CRs for TS36.306 have been agreed in R2-165855 and R2-165856.

Decision: The document is noted.

LAA

R1-166066 Long Term Evolution in Operation in Unlicensed Spectrum Must Not Interfere with Wi-Fi City of Madison (Office of the Mayor of)

The document was presented by RAN1 Chair.

Decision: The document is noted.

R1-166083 Response to Wi-Fi Alliance comments on "Way forward on coexistence tests for LAA" RAN4, Qualcomm, Ericsson

The document was presented by RAN1 Chair.

Decision: The document is noted.

R1-167928 LS on CSI measurement ambiguity in LAA RAN4, LGE

The document (Incoming LS received in RAN1#86) was presented by Joon Kui Ahn from LGE and asked RAN1 to clarify whether following sentence could be applied in LAA CSI reporting case or not.

"*For a non-BL/CE UE, if there is no valid downlink or no valid special subframe for the CSI reference resource in a serving cell, CSI reporting is omitted for the serving cell in uplink subframe n.*" (in RAN1 specification TS 36.213 for CSI reporting)

Decision: The document is noted.

R1-166812 Discussion on RAN4 LS on CSI measurement ambiguity in LAA LG Electronics

Decision: The document is noted. Continue offline discussion until Friday – (LGE)

Friday: No progress – continue discussion until the next meeting.

R1-167880 Reply LS on Rel-13 LAA specifications RAN, Qualcomm, NTT DOCOMO

The document was presented by Srinivas Yerramalli from Qualcomm

Decision: The document is noted.

R1-167881 "Response to Liaison Statement on coexistence simulation results for DL only LAA" Wi-Fi Alliance

The document is a response to the liaison statement questions asked in R1-161396, summarizes changes made to the ns-3 simulator, and how such changes affect the results presented in R1-156621.

Decision: The document is noted. Continue offline discussion until Friday, if needed –(Qualcomm)

R1-167118 Draft response LS to WFA regarding LAA Qualcomm Incorporated

Friday Decision: Qualcomm withdrew R1-167118 as there did not seem to be a need identified (in this meeting at least) to respond to the LS.

R1-167908 Review of 3GPP LAA Specification Rel. 13 IEEE 802 LMSC

The document states that some of the comments in IEEE 802's Liaison Statement to 3GPP RAN1 dated 18 March 2016 (802.19-16-0037-09) have been resolved satisfactorily and represents a great success for the consensus process that started with the 3GPP LAA Workshop back in August 2015. However, there are a number of important outstanding issues, for which IEEE requests RAN1 to continue to look for satisfactory compromises with IEEE 802 and other interested stakeholders..

Decision: The document is noted. Continue offline discussion until Friday – (Qualcomm)

Friday Decision:

R1-166666 Draft response LS to 802dot11 regarding LAA Qualcomm Incorporated

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The document is noted.

eMTC

R1-166069 LS on HARQ process selection for UL asynchronous HARQ RAN2, Huawei

The document was presented by Matthew Webb from Huawei.

- In asynchronous HARQ operation, HARQ process is associated with TTI based on the received UL grant except for UL grant in RAR. Each asynchronous HARQ process is associated with a HARQ process identifier. For UL transmission with UL grant in RAR, HARQ process identifier "0" is used.

Discussion: No action to RAN1 – no impact to spec
Decision: The document is noted.

R1-166081 LS on continuous uplink transmission in eMTC RAN4, Intel

The document was presented by Debdeep Chatterjee from Intel and asks RAN1 to specify UL compensation gaps, including related UE behaviour.
Discussion: No action to RAN1.
Decision: The document is noted.

NB-IoT

R1-166061 Reply LS on questions on NB-IOT CT1, Nokia

The document was presented by Rapeepat Ratasuk from Nokia.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-166070 LS to RAN1 on WLAN RSSI RAN2, Nokia

The document was presented by Klaus Hugl from Nokia and asks RAN1 to correct the definition of WLAN RSSI.
Decision: The document is noted.

R1-167547 Correction to the Beacon RSSI definition Nokia, Intel, Alcatel-Lucent Shanghai Bell, Qualcomm Incorporated, Ericsson

Decision: The document is noted and CR0034 to 36.214 (Rel-12) is agreed.

R1-167549 Correction to the WLAN RSSI definition Nokia, Intel, Alcatel-Lucent Shanghai Bell, Qualcomm Incorporated, Ericsson

Decision: The document is noted and CR0035 to 36.214 (Rel-13) is agreed.

Latency reduction

R1-166071 LS to RAN1 on RAN2 agreements on skipping Uplink transmission RAN2, Nokia

The document was presented byTimo Lunttila from Nokia and asks RAN1

- to confirm the RAN2 assumption that non-adaptive retransmissions on SPS resource are done based on RV 0 and to provide feedback if any concern,
- to align RAN1 specifications if needed regarding the assumption that the UCI should be sent on PUCCH even if there is a valid PUSCH allocation on that subframe

Decision: The document is noted.

R1-167507 Addition of LTE_LATRED_L2-Core Ericsson LM

Add that PUSCH is not transmitted if not high layers generates a MAC entity for the corresponding HARQ process
Decision: The document is noted and CR0709 of 36.213 is for email approval until Sept 12th (Spec editor – Motorola Mobility)

R1-167023 On skipping uplink transmission Nokia, Alcatel-Lucent Shanghai Bell

The document was presented byTimo Lunttila from Nokia.

- Proposal #1: The RAN2 working assumption on using RV0 with non-adaptive retransmissions on SPS resources can be confirmed.
- Proposal #2: In the case of UL skipping, UCI consisting of HARQ-ACK, periodic CSI and/or scheduling request indicator is transmitted on PUCCH following the legacy rules for the case when there is no PUSCH transmission.
- Proposal #3: An UL grant triggering Aperiodic CSI transmission is considered as a regular dynamic UL grant. UL skipping does not apply in this case.

Decision: The document is noted.

R1-167506 Discussion on skipping Uplink transmission Ericsson

The document was presented by Daniel Larsson from Ericsson and proposes to:

- Agree to the LS to RAN2 in R1-167505
- Agree to the CR in R1-167507

Decision: The document is noted.

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R1-167505 [DRAFT] LS on RAN2 agreements on skipping Uplink transmission Ericsson

R1-166665 Discussion of LS from RAN2 on skipping uplink transmission Qualcomm Incorporated
Decision: The document is noted.

Agreements:
- In the case of UL skipping, UCI consisting of HARQ-ACK, periodic CSI and/or scheduling request indicator is transmitted on PUCCH following the legacy rules for the case when there is no PUSCH transmission.
- An UL grant triggering Aperiodic CSI transmission is considered as a regular dynamic UL grant. UL skipping does not apply in this case

Continue discussion until Friday – (Nokia)
Friday:
R1-168527 [DRAFT] Reply LS on RAN2 Agreements on Skipping Uplink Transmission Nokia
Decision: The document is noted and final LS is agreed in R1-168528.

R1-166084 Reply LS on SRS carrier switching interruption time RAN4, Huawei
The document was presented by Weimin Xiao from Huawei.
Decision: The document is noted and acknowledged by RAN1.

V2X
R1-166060 LS to RAN1 on RAN2 agreements related to V2X RAN2, LGE
The document was presented by Hanbyul Seo from LGE and provides RAN2 TP (R2-163650) capturing agreements of RAN2#93bis – already included in the TR 36.885.
Decision: The document is noted.

R1-166062 LS to RAN1 on SPS RAN2, LGE
The document was presented by Hanbyul Seo from LGE and informs RAN1 that for UL SPS, the majority of companies agree that from a RAN2 point of view, it is not necessary to send an indication to the eNB that an SPS grant will not be used. Therefore, the working assumption on "the UE can indicate to the eNB that it does not intend to transmit data before a transmission associated to an SPS configuration" is not needed.
Decision: The document is noted.

R1-166068 Reply LS on EPC procedures for providing eNB with V2X authorization information RAN2, LGE
The document was presented by Hanbyul Seo from LGE and provides answers to SA2.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-166072 LS to RAN1 on agreed TPs RAN2, LGE
The document was presented by Hanbyul Seo from LGE and provides RAN2 TPs (R2-164495, R2-164497, R2-164553) capturing agreements of RAN2#94 – already included in the TR 36.885.
Decision: The document is noted.

V2V
R1-166063 LS on V2V transmission path selection RAN2, Huawei
The document was presented by Philippe Sartori from Huawei and provides the follwing RAN2's agrrements:
- The following configurations are allowed by eNB for transmission of V2V: 1) Uu only, 2) PC5 only and 3) both Uu and PC5 for V2V transmissions in different carriers.
- If both Uu and PC5 are configured for V2V transmissions, it is left up to UE upper layers which path is selected. FFS whether any additional AS information is provide to upper layers.
- The eNB can configure the V2V transmission configuration in SIB and/or dedicated signalling.

Decision: The document is noted.

R1-166082 Reply LS on V2V multicarrier configuration RAN4, LGE, Ericsson
The document was presented by Stefano Sorrentino from Ericsson and shows RAN4 conclusion to scenarios supporting multiple component carrier (MCC) operation for V2V services based on LTE sidelink functionality:
- Analysis and specification of transmission and reception requirements for single component carrier (CC) operation will be completed as a first priority (e.g. for both licensed LTE bands and ITS spectrum at 5.9GHz).
    - The analysis and specification of transmission and reception requirements for MCC V2V operation will be completed in RAN4 as second priority as part of the V2V WI.

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  - If the MCC operation for V2V service can't be completed within V2V WI time line, RAN4 suggests to further study in Rel-14 pending agreement in the RAN plenary. Therefore MCC operation for V2V operation will be supported in Rel-14.
- Note that MCC V2V operation will depend on the V2V UE RF architecture and RAN4 needs further time to study support of MCC V2V operation and LTE operation with intra UE capabilities.

Decision: The document is noted.

R1-167878 LS on V2V Authorization RAN3, Huawei

RAN3 believes that the V2V authorization information needs to be provided to the eNB from a trusted node (i.e. the MME or another eNB), and to be extensible in the future (i.e. further considering the possible outcome of the RAN V2X SI). RAN3 has technically endorsed the attached CRs which introduce a *Vehicular Services Authorized* IE.

Discussion: No action to RAN1.
Decision: The document is noted.

Network Assistance for Network Synchronization in LTE

R1-166085 LS on Network Assistance for Network Synchronization in LTE RAN, Huawei

The document was presented by Elean Fan from Huawei and asks RAN1 clarifying the feasibility on standardization of the time-stamps T1 and T2 for received RACH preamble in case of Solution 1 (network based solution reusing the existing signaling during handover).
Decision: The document is noted.

R1-167177 Feasibility on standardization of the time-stamps for received RACH preamble Huawei

- UE transmitting RACH upon handover is an existing procedure in LTE
- To get the time stamps T1 and T2 upon receiving the RACH preamble, no UE changes are required
- To get the time stamps T1 and T2 upon receiving the RACH preamble, no additional physical layer signalling is required

Decision: The document is noted.
R1-166198 Reply LS on Network Assistance for Network Synchronization in LTE Huawei

Agreements:

- UE transmitting RACH upon handover is an existing procedure in LTE
- RAN1 does not need to specify eNB measurements to support this feature (if specified)

R1-167916 Reply LS on Network Assistance for Network Synchronization in LTE RAN1
Decision: The document is agreed.

Mobility enhancements

R1-166074 LS on the evaluation of simultaneous transmission and reception RAN2, ZTE
Decision: The document is noted.

R1-166078 Response LS on the feasibility of mobility enhancement solutions RAN3, ZTE

There is no information exchanged, today, related to timing offset, between source and target eNBs in asynchronous case over any RAN3 interfaces.

Decision: The document is noted.

R1-166080 Reply LS on the feasibility of mobility enhancement solutions RAN4, ZTE
Decision: The document is noted.

R1-167810 Summary of email discussion on replying LS for mobility enhancement solutions ZTE Corporation
Decision: The document is noted.

VoLTE

R1-166075 LS on VoLTE and video quality related enhancements RAN2, Ericsson

The document was presented by Johan Bergman from Ericsson and asks RAN1 to investigate the trade-off between packet delay budget and achievable coverage to assess the benefits of VoLTE/video quality related enhancements, and provide feedback.
Decision: The document is noted.

HSPA (see AI6.3)

R1-166067 LS on RAN2 aspects on MC enhancements RAN2, Huawei
R1-166076 LS on Multi-carrier enhancements RAN3, Huawei

NR

R1-166058 Updated characteristics of terrestrial IMT systems for frequency sharing / interference analysis in the frequency range between 24.25 GHz and 86 GHz ITU-R WP5D

The document was presented by RAN1 Chair en behalf of ITU-R and the following updates from the previous version:

1. Three parameters (access technique, modulation parameters and channel spacing) were removed.

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2. Two new parameters (Duplex Method and SINR operating range) were added. However, the relevance of Duplex Method parameter for sharing studies is still being considered.

Decision: The document is noted.

R1-167375 [Draft] LS on Parameters for WP5D sharing and compatibility studies NTT DOCOMO, INC.

The document was presented by Kazuaki Takeda from NTT DOCOMO.

Discussion: Qualcomm → 1024QAM should be mentioned – to be considered at the same level as the others
Samsung → concern of introducing 1024QAM (no proposal yet available)

Decision: The document is noted and agreed with updated Note 2 in R1-167917 as follows:

Note 2: There is no agreement in RAN1, but the use of QPSK, 16QAM, 64QAM, 256QAM, and possibly 1024QAM constellations are at least considered, while details, e.g., mapping of bits to constellation points, are under study. Accordingly, SINR operating range includes at least the SINR values for which QPSK, 16QAM, 64QAM, 256QAM, and possibly 1024QAM can be used.

R1-166059 MODELLING AND SIMULATION OF IMT NETWORKS FOR USE IN SHARING AND COMPATIBILITY STUDIES ITU-R WP5D

The document was presented by RAN1 Chair en behalf of ITU-R and describes detailed IMT system parameters needed for modelling, their implementation in the simulations, and the methodology to calculate the aggregate effect of potential interference generated by an IMT system.

Decision: The document is noted.

R1-167882 Proposal for Improved RMa model and upgraded open source channel simulator NYU Wireless

The document shares the results of recent modelling and measurements that will correct errors in the existing 3GPP RMa model as it appears in TR 38.900, and offers recently published results that may help in system and link-level simulations, as well as highlighting the use of these results in an improved version of an open source simulator discussed in a July 2016 IEEE T-MTT paper and in the upcoming October 2016 "All Things Cellular" paper.

Decision: The document is noted.

R1-166064 INCREASING LEVELS OF RF NOISE IN THE ENVIRONMENT AND CONSEQUENT INTERFERENCE TO RADIOCOMMUNICATION SERVICES ITU-R WP 1A

The document was presented by RAN1 Chair en behalf of ITU-R and deals with increasing levels of RF noise radiated or superimposed along the electrical mains supply and the consequent increase in instances of EMI.

Decision: The document is noted.

R1-166077 Reply LS on Formation of IEEE 1914 Next Generation Fronthaul Interface Working Group RAN3, Intel

The document was presented by … from Intel and informs IEEE 1914 that in the context of the NR SI, RAN architecture and functional splits are being studied by RAN3.

Discussion: No action to RAN1.

Decision: The document is noted.

R1-166079 LS on Characteristics of terrestrial IMT systems for frequency sharing/interference analysis in the frequency range between 24.25 GHz and 86 GHz RAN4, Nokia

The document was presented by Tuomo Säynäjäkangas from Nokia.

Discussion: No action to RAN1.

Decision: The document is noted.

R1-167879 Reply LS to ITU-R WP5D/TEMP/39(Rev.2) = RP-160508 on Characteristics of terrestrial IMT systems for frequency sharing/interference analysis in the frequency range between 24.25 GHz and 86 GHz RAN, Nokia

The document was presented by Tuomo Säynäjäkangas from Nokia and confirms the following schedule agreed RAN:

RAN#72 (June 2016): RAN send LS to ITU-R WP5D including time plan and expected future LSs from 3GPP to WP5D
RAN#73 (Sep 2016): RAN send LS to ITU-R WP5D on initial system characteristics based on RAN1&RAN4 input
RAN#74 (Dec 2016): RAN send LS to ITU-R WP5D on final system characteristics based on RAN1&RAN4 input
Note: Dependent on the ITU-R WP5D deadline (which is not yet published in RP-160508), RAN may approve the output by correspondence after the Dec. 2016 meeting.

Decision: The document is noted.

R1-166087 LS on 5G NR study – mMTC use case RAN, MediaTek

The document was presented by … from MediaTek and informs RAN1 that within the scope of the NR Study, NB-IoT and eMTC should be used as the reference benchmark for assessing the performance of new proposals according to mMTC use case.

Decision: The document is noted.

R1-167534 Discussion on benchmark mMTC with NB-IoT/eMTC MediaTek Inc.

- Proposal #1: The new techniques for mMTC should provide significant gain compared with NB-IoT/eMTC.

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- Proposal #2: Building penetration loss is added in channel model in system level evaluation for mMTC.
- Proposal #3: Performance in coverage extension (i.e., 154dB, 164dB) should be evaluated and benchmarked with NB-IoT/eMTC. Data rate v.s. MCL curve can be used as a metric.
- Proposal #4: Spectral efficiency in both normal coverage and extended coverage level should both be evaluated and benchmarked with NB-IoT/eMTC. Sum throughput v.s. MCL can be used as a metric.
- Proposal # 5: PAPR and CM of NR for mMTC should not be higher than NB-IoT, especially in extended coverage.
- Proposal #6: The BOM cost of low-end mMTC device in NR needs to be benchmarked with NB-IoT/eMTC.
- Proposal #7: Single solution is strived for all the scenarios (e.g., normal coverage and extended coverage) and operation modes (e.g., standalone and inband deployed with eMBB/ URLLC).

Decision: The document is noted.

R1-166065 **LS on 5G millimeter wave channel simulator** **NYU WIRELESS**
The document was presented by RAN1 Chair en behalf of NYW and shares the results of the recent July 2016 IEEE T-MTT paper, and provides information about a new public resources useful for 5G air interface and system design work.
Decision: The document is noted.

R1-168136 [DRAFT] Reply LS on VoLTE and video quality related enhancements CMCC
Agreed in R1-168256

R1-168295 Draft LS regarding agreements for FeMTC
Agreed in R1-168300

The document was presented by … from … and
Discussion: .
Decision: The document is noted.

6 UTRA

R1-168038 **Chairpersons' summary of the UMTS sessions** **UMTS Session Chairpersons (Huawei, Ericsson)**
The document was presented by Carmela Cozzo from Huawei and Gerardo Medina.
Decision: The document is endorsed and incorporated as follows.

Incoming Liaison Statements related to AI 6.3.
R1-166067 **LS on RAN2 aspects on MC enhancements** **RAN2, Huawei**
Decision: The document (RAN2 agreed TP) is noted.
R1-166076 **LS on Multi-carrier enhancements** **RAN3, Huawei**
Decision: The document (RAN3 agreed TP) is noted.
Both TPs have already been included in TR25.707.

6.1 Maintenance of UTRA Releases 4 – 13

6.1.1 FDD

R1-166495 **Clarifications on UL Discontinuous Transmission with DCH enhancements** **Qualcomm Europe Inc.(France)**
Decision: CR0749 to 25.214 (Rel-12, F) is agreed.
R1-166496 **Clarifications on UL Discontinuous Transmission with DCH enhancements (Rel. 13)** **Qualcomm Europe Inc.(France)**
Decision: CR0750 to 25.214 (Rel-12, A) is agreed.

R1-167681 **Discussion on power scaling for R13 DC HSUPA with CS** **Huawei, HiSilicon**
R1-167711 **25.214 CR (Rel-13, F) Correction of Dual Carrier HSUPA enhancements for UTRAN CS** **Huawei, HiSilicon**
Decision: The document is revised and CR0753r1 to 25.214 (Rel-13, F) is agreed in R1-168031

R1-167709 **25.214 CR (Rel-13, F) Correction of DCH enhancements** **Huawei, HiSilicon**
Discussion: CR category should be A
Decision: The document is noted, revised and CR0751r1 to 25.214 (Rel-13, A) is agreed in R1-168032
R1-167710 **25.214 CR (Rel-12, A) Correction of DCH enhancements** **Huawei, HiSilicon**
Discussion: CR category should be F
Decision: The document is noted, revised and CR0752r1 to 25.214 (Rel-12, F) is agreed in R1-168033

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R1-167758 **On incorporating the definition of "UL DPCH 20ms Mode" in TS 25.212 Ericsson**
Decision: The documment is noted and CR is not pursued.
R1-167759 **On incorporating the definition of "UL DPCH 20ms Mode" in TS 25.212 Ericsson**
Decision: The documment is noted and CR is not pursued.
R1-167760 **Editorial clarification on the definitions of "UL DPCH 10ms Mode" and "UL DPCH 20ms Mode" of DCH enhancements for UMTS Ericsson**
Decision: CR0754 to 25.214 (Rel-12, D) is agreed.
R1-167761 **Editorial clarification on the definitions of "UL DPCH 10ms Mode" and "UL DPCH 20ms Mode" of DCH enhancements for UMTS Ericsson**
Decision: CR0755 to 25.214 (Rel-13, A) is agreed.

R1-167762 **On incorporating the definition of "UL DPCH 20ms Mode" and adding the TS 25.321 in the list of references of TS 25.211 Ericsson**
Decision: The document is noted, revised and CR0323r1 to 25.211 (Rel-12, D) is agreed in R1-168035 (without the change: addition of the definition)

R1-167763 **On incorporating the definition of "UL DPCH 20ms Mode" and adding the TS 25.321 in the list of references of TS 25.211 Ericsson**
Decision: The document is noted, revised and CR0324r1 to 25.211 (Rel-13, F) is agreed in R1-168036 (without the change: addition of the definition)

6.1.2 TDD

None.

6.2 DTX/DRX enhancements in CELL_FACH - WID in RP-160185

6.2.1 DRX improvements

R1-167682 **Considerations on DRX in CELL_FACH Huawei, HiSilicon**

R1-167764 **On incorporating the DL scheduling notification based on regular HS-SCCH control information to the new power saving mechanism in CELL_FACH Ericsson**

R1-167765 **DL scheduling notification based on regular HS-SCCH control information as part of the new power saving mechanism in CELL_FACH Ericsson**

R1-167813 **Discussions on HS-SCCH DRX in CELL_FACH design Qualcomm Europe Inc.(France)**
R1-167814 **Introduction of HS-SCCH Order for HS-SCCH DRx feature in enhanced Cell Fach Qualcomm Europe Inc.(France)**
R1-167815 **UE Procedures for HS-SCCH DRx feature in enhanced Cell Fach Qualcomm Europe Inc.(France)**

Conclusions for 6.2.1:
RAN1 recommends a Rx Burst duration of 1 subframe or 2 subframes in the HS-DSCH receiving formula specified in TS 25.331 (LS to be sent to RAN2)
R1-168030 **LS on Updates on HS-SCCH DRx Feature in Cell Fach RAN1, Qualcomm**
Decision: The document is noted and LS is agreed.

HS-SCCH order is to be used to signal a UE wake-up trigger.
Email discussion until next plenary submission deadline (Sept 9th on Qualcomm CRs.

6.2.2 DTX improvements

R1-167683 **Considerations and evaluation of DTX in CELL_FACH Huawei, HiSilicon**
R1-167684 **DTX solution in CELL_FACH Huawei, HiSilicon**
R1-167766 **A complementary assessment on the potential gains associated to the introduction of DTX in CELL_FACH Ericsson**
R1-167767 **Technical findings on introducing DTX in CELL_FACH Ericsson**

Conclusions:
Based on R1-167766 findings, the average gains from DTX in cell FACH range from 0.02 to 0.10 (10 resources) and from 0.07 to 0.34dB for the case of 25 common E-DCH resources configured in the cell. The following table summarizes the gains from DTX in CELL_FACH

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Summary of the potential gains that can be obtained by fully applying DTX on the stand alone UL DPCCH in CELL_FACH without severely impacting the cell's capacity

Average Blocking Target 5%	Back-off timer configurations	10 Common E-DCH resources configured in the Cell		25 Common E-DCH resources configured in the Cell	
		Range of the Percentile Gain (90-99% Percentile)	Range of the Average Gain	Range of the Percentile Gain (90-99% Percentile)	Range of the Average Gain
	4TTIs – 24TTIs (8ms-48ms)	0.11508dB – 0.2333 dB	0.0206dB – 0.1028 dB	0.2333dB – 0.6085 dB	0.0745dB – 0.3419dB

6.3 Multi-Carrier enhancements for UMTS - WID in RP-161259.

R1-168089 **LS on Multi-Carrier enhancements**
W.r.t configuring Multi-Carrier enhancements in combination with legacy features, RAN2 would like to understand, in case that primary and secondary uplink frequency is configured with different TTIs, whether it is feasible to configure uplink DTX on either primary frequency or secondary frequency or both.
Decision: The document is noted.

6.3.1 2ms+10ms and 10ms+10ms configurations for (DB)-DC-HSUPA

R1-167685 **Overview of multicarrier enhancements Huawei, HiSilicon**
R1-167686 **Initial considerations on power scaling Huawei, HiSilicon**

Agreement: The legacy power scaling can be reused for DB-DC/DC 10ms+10ms TTI configurations.

R1-167687 **Initial considerations on TTI switching Huawei, HiSilicon**
R1-167768 **TTI Switching for Multicarrier Enhancements in UMTS Ericsson**

Agreement: It is RAN1 opinion that the TTI switching mechanism should be introduced in Multicarrier Enhancements for HSUPA.

R1-168037 **Ls to RAN2/3 on RAN1 progress on MC Enhancements, Huawei**
Decision: The document is noted and the LS is agreed.

6.4 Others

R1-167755 **PRACH optimization for latency reduction during uplink signalling traffic Nokia, Alcatel-Lucent Shanghai Bell**

7 E-UTRA

7.1 Maintenance of E-UTRA Releases 8 – 13

Only essential corrections.
Note that individual companies can submit draft CRs to this agenda item for Rel-13 items.

R1-166190 **Introduction of 1.2Gbps and 1.6Gbps UE categories in Rel-13 Huawei, HiSilicon, SoftBank**
Proposal 1: Introduce DL UE categories 18 and 19 to support DL peak data rate of 1.2Gbps and 1.6Gbps respectively
Proposal 2: Reuse UL cat 3, 5, 7 and 13 for DL cat 18 and 19 as corresponding UL categories
The specification impacts on TS36.212 can be found in a companion contribution [R1-167401].
Decision: The document is noted.
R1-167401 **Introduction of 1.2Gbps and 1.6Gbps UE categories in Rel-13 Huawei, HiSilicon, NTT DOCOMO, SoftBank**
The document was presented by Xia Yuan from Huawei.
Assuming 1.2Gbps and 1.6Gbps UE categories in Rel-13 also support 8*8 MIMO deployment, the CR defines the soft buffer assumption for 8-layer encoding for 1.2Gbps and 1.6Gbps UE categories in Rel-13.
Discussion: . CR not needed if 8*8 MIMO is not supported in the two new UE categories.
If 8*8 MIMO is supported, CR is needed and RAN1 should let RAN knows about it

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Decision: The document is noted and revised as a draft CR in

R1-168311 Introduction of 1.2Gbps and 1.6Gbps UE categories in Rel-13 Huawei, HiSilicon, NTT DOCOMO, SoftBank

Decision: The document is noted and the draft CR is technically endorsed by RAN1.

R1-168312 [Draft] LS on introducing 1.2Gbps and 1.6Gbps UE categories in Rel-13 Huawei

Decision: The document is noted and final LS is agreed in R1-168377

R1-167398 Correction on storing soft channel bits for different UE categories in Rel-11 Huawei, HiSilicon, NTT DOCOMO, SoftBank

Decision: The document is noted, revised and CR0704r1 (Rel-11, F) is agreed in R1-168313. Also supported by Intel.

R1-167399 Correction on storing soft channel bits for different UE categories in Rel-12 Huawei, HiSilicon, NTT DOCOMO, SoftBank

Decision: The document is revised and CR0705r1 (Rel-12, A) is agreed in R1-168314. Also supported by Intel.

R1-167400 Correction on storing soft channel bits for different UE categories in Rel-13 Huawei, HiSilicon, NTT DOCOMO, SoftBank

Decision: The document is revised and CR0706r1 (Rel-13, A) is agreed in R1-168315. Also supported by Intel.

R1-167902 Introductions of new UE categories Qualcomm Incorporated

R1-168356 Way Forward on introduction of new UL categories Qualcomm

- Choose Alternative 2
  - Send an LS to RAN2 recommending developing the necessary CRs and sending them to RAN #73
- Note: This doesn't mean approving any of these categories – that would be decided at the Plenary

Decision: The document is noted.

R1-168357 [Draft] LS on introduction of new UL categories Qualcomm

R1-168431 Way Forward on introduction of new UL categories Qualcomm

- Choose Alternative 1
- Send two separate LSs to RAN2 recommending developing the necessary CRs and sending them to RAN#73
  - Introducing UL Category 19-20 with *TEI13*

UE UL Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL	Support for 256QAM in UL
UL Category 19 – Rel-13	226128	75376	Yes	No
UL Category 20 – Rel-13	301504	75376	Yes	No

  - Introducing UL Category 21-22 with *LTE_UL_CAP_enh-Core*

UE UL Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL	Support for 256QAM in UL
UL Category 21 – Rel-14	316584	105528	Yes	Yes
UL Category 22 – Rel-14	422112	105528	Yes	Yes

- Note: This doesn't mean approving any of these categories – that would be decided at the Plenary

Decision: The document is noted and the WF is agreed. Qualcomm requested to take a note that their preference remains Alt. 2.

R1-168432 [Draft] LS on introduction of new UL categories in Rel-13 Qualcomm

Decision: The document is noted and final LS is agreed in R1-168459.

R1-168433 [Draft] LS on introduction of new UL categories in Rel-14 Qualcomm

Decision: The document is noted and final LS is agreed in R1-168460.

7.1.1 Maintenance of E-UTRA Release 8 – 12

R1-166194 Discussion on the understanding of maximum code rate Huawei, HiSilicon

The document was presented by Xia Yuan from Huawei.

For Rel-12 DL UE categories and onwards, they shall NOT skip decoding a transport block in an initial transmission if the effective channel code rate is lower than or equal to 0.931, no matter whether they have 256QAM capability or not.

Decision: The document is noted.

R1-166229 Clarification on HARQ feedback under TDD-FDD CA in Rel-12 Qualcomm Incorporated

The document was presented by Wanshi Chen from Qualcomm and deals with one particular issue in TDD/FDD CA, where an FDD CC is configured as Pcell and with one of the DL MIMO transmission modes, while one or two TDD CCs are configured as Scell. In a subframe when a Pcell PUCCH or a PUSCH is transmitted and when the corresponding subframe in the TDD Scell(s) is an UL subframe, the following intended behavior is recommended to be confirmed by RAN1:

- If only one single codeword is detected on the FDD Pcell,
  - If PUCCH is transmitted, PUCCH format 1a is used;
  - If PUSCH is transmitted, 2-bit HARQ is assumed.

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Discussion: Intel→ format 1b should be feedback
Decision: The document is noted. Continue offline discussion until Friday (Qualcomm)
Friday
R1-168501 Offline summary on Clarification on HARQ feedback under TDD-FDD CA in Rel-12 (R1-166229) Qualcomm

- The conclusion for the issue discussed in R1-166229 is aligned with RAN1 understanding, with the clarification that "PUCCH format 1a is *effectively* used" for the case of PUCCH format 1b with channel selection, due to the codepoints (ACK, ACK) or (NAK, NAK) for PUCCH format 1b when only one TB is detected for the MIMO Pcell
- No CR is necessary

R1-167432 draft CR on the correction from SC-FDFMA to SC-FDMAPanasonic Corporation
The document was presented by Alex Golitschek from Panasonic.
Decision: The document is noted and agreed as CR0279 to 36.211 in R1-167933.

7.1.2 Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers

R1-166600 Draft 36.213 CR Clarification on HARQ-ACK transmission CATT
The document was presented by Fang Chen Cheng from CATT.
Decision: The document is noted and agreed as CR0719 to 36.213 in R1-167936.

7.1.3 Maintenance of Release 13 licensed-assisted access to unlicensed spectrum

R1-166138 Correction on "special subframe" for frame structure type 3 in 36.213 for Rel-13 LAA Huawei, HiSilicon
The document was presented by Xia Yuan from Huawei.
Decision: The document is noted and agreed as CR0718 to 36.213 in R1-167934.

R1-166813 Correction on CSI reference resource definition in LAA LG Electronics
The document was presented by Joon Kui Ahn from LGE.
Decision: The document is noted. Continue offline discussion until Friday.
Friday: Not pursued.

R1-167180 Correction for energy detection threshold for multi-carrier LBT operation in 36.213 for Rel-13 LAA Huawei, HiSilicon
Decision: The document is not pursued.

R1-167181 Correction for PHICH resource reservation on the LAA cell in 36.211 for Rel-13 LAA Huawei, HiSilicon
The document was presented by Xia Yuan from Huawei.
Decision: The document is noted and agreed as CR0280 to 36.211 in R1-167935.

R1-167402 Correction on the determination of EPDCCH starting position ITRI
The document was presented by Chien-min Lee from ITRI.
Decision: The document is noted. Continue offline discussion until Friday.
Friday: CR0264 to 36.211 is agreed.

R1-167785 Draft CR on LAA post transmission backoff BROADCOM LIMITED
The document was presented by Sindhu Verma from Broadcom.
Decision: The document is noted. Continue offline discussion until Friday.
Friday:
R1-168546 CR on LAA post transmission backoff BROADCOM LIMITED
Decision: The document is noted. Typo in CR number. CR is revised and agreed as CR0741r1 in R1-168555.

7.1.4 Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE

R1-166230 Draft CR on FD-MIMO codebooks Qualcomm Incorporated
Decision: The document is noted. Continue offline discussion until Friday – Chao (Qualcomm)
Friday: revised in **R1-167937** and agreed as CR0740 to 36.213 in R1-168544.

R1-166337 Correction on FD-MIMO Codebooks in 36.213 Nokia, Alcatel-Lucent Shanghai Bell, Samsung
The document was presented by Min Zhang from Nokia.
Decision: The document is noted and CR0693 to 36.213 is agreed.
R1-166502 Correction on class B codebook Intel Corporation
Decision: The document is not pursued.

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R1-166338 Correction on RRC Parameters for SRS Enhancement in 36.213 Nokia, Alcatel-Lucent Shanghai Bell
The document was presented by Min Zhang from Nokia.
Decision: The document is noted and CR0694 to 36.213 is agreed.

R1-166501 Quasi co-location assumptions for DM-RS antenna ports in MU-MIMO Intel Corporation
The document was presented by Alexei Davidov from Intel.
Discussion: .
Decision: The document is noted. Continue offline discussion until Friday.
Friday
R1-168365 Quasi co-location assumptions for DM-RS antenna ports in MU-MIMOIntel Corporation
Decision: The document is not pursued.

R1-166503 Correction on bitwidth of class A codebook Intel Corporation
Decision: The document is noted and CR0213 to 36.212 is agreed in R1-167938.

R1-167168 Corrections on CRI bit width in 36.212 Huawei, HiSilicon
Decision: The document is noted and CR0214 to 36.212 is agreed in R1-167939.

R1-167678 Corrections on Codebooks in 36.213 Huawei, HiSilicon
Decision: The document is noted and CR0710 to 36.213 is agreed.

R1-167404 Correction on the citation of table indexs for mapping of ICRI to MCRIITRI
Decision: The document is noted and CR0708 to 36.213 is agreed.

7.1.5 Maintenance of Release 13 further LTE physical layer enhancements for MTC

R1-168400 Chairman's notes of AI 7.1.5 on Maintenance of Release 13 further LTE physical layer enhancements for MTC Ad-Hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is endorsed and content is incorporated as follows.

UL compensation gaps
R1-166655 Considerations on UL compensation gaps Sony

Valid subframes
R1-166237 On valid MBSFN subframes and SIB2 decoding for eMTC Qualcomm Incorporated
R1-166238 Draft LS for valid MBSFN subframes for eMTC Qualcomm Incorporated
Conclusion: Continue offline discussion coming up a suggested text for changing 36.331 (Qualcomm), as part of the LS.
Friday:
R1-167959 Draft LS to RAN2 regarding valid MBSFN subframes for eMTC Qualcomm
Decision: The document is noted. The LS in R1-167959 is endorsed with "MBSFN subframes are given by (2)" changed to "MBSFN subframes are given by (1)". LS is revised and final version is agreed in R1-168425.

R1-167945 Draft CR for MBSFN subframes and SIB2 decoding Qualcomm Incorporated
Decision: The document is noted. The CR is R1-167945 is endorsed, and final CR is agreed as CR0721r2 to 36.213 (Rel-13, F) in R1-168437.

R1-167433 Clarification of valid subframe in eMTC Panasonic Corporation
Decision: The document is noted. The CR in R1-167433 is endorsed with the update non-BL/CE, and final CR is agreed as CR0283 to 36.211 (Rel-13, F) in R1-168234.

R1-167434 Clarification of valid subframe in eMTC Panasonic Corporation
Decision: The document is noted. The CR in R1-167434 is endorsed with potential parameter name update (for offline discussion), and final CR to be prepared in R1-168235
Note: this CR is also to be included part of the offline discussion for the LS to RAN2 to be drafted by Alberto (Qualcomm)
Friday:
R1-168235 Clarification of valid subframe in eMTC Panasonic Corporation
Decision: The document is not presented (different content). Email discussion/approval based on R1-167434 until Sept 1st (Panasonic)

R1-167854 MBSFN subframes are invalid DL BL/CE subframes for BL/CE UE Ericsson
Not pursued.

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DCI
R1-166236 CR for SRS bit in DCI Qualcomm Incorporated
R1-166622 Presence of SRS bit in DCI 6-0A and 6-1A Sequans Communications
R1-166624 eMTC corrections for RAN1 specifications Sequans Communications (Section 6)
Decision: The CR in R1-166236 is endorsed, and agreed as CR0738 to 36.213 (Rel-13, F) in R1-168535.

R1-167155 On the mapping of TPC command field to power correction values in TS 36.213 Huawei, HiSilicon
Decision: The CR in R1-167155 is endorsed with the following update "0/3/4/6-0A", and agreed as CR0723 to 36.213 (Rel-13, F) in R1-168156.

R1-167737 Draft CR for clarification of DCI sizes for format 6-1A (TM6 and TM9) in TS 36.212 Virtuosys Limited
Decision: Discuss further offline
Friday:
R1-168161 Draft CR for clarification of DCI sizes for format 6-1A (TM6 and TM9) in TS 36.212 Virtuosys Limited
Decision: The CR in R1-168161 is agreed in principle, and final CR is agreed in R1-168452.
Post meeting: MCC noticed that wrong CR number was provided and revised R1-168452 in R1-168212 (CR0216r1 to 36.212)

MPDCCH
R1-167941 Draft CR for clarification on MPDCCH monitoring on SFN rollover and search space overlap Qualcomm Incorporated
Decision: Continue offline discussion, including R1-167862
R1-167862 Overlapping MPDCCH search spaces for BL/CE UE Ericsson
Friday:
R1-168509 Clarification on MPDCCH monitoring on SFN rollover and search space overlap Qualcomm Incorporated
Decision: CR0736 to 36.213 (Rel-13, F) is agreed.

R1-166621 MPDCCH search-space with Temporary C-RNTI Sequans Communications
Decision: CR0259 to 36.211 (Rel-13, F) is agreed.
R1-166624 eMTC corrections for RAN1 specifications Sequans Communications (Section 3)

R1-167154 Correction on MPDCCH in the special subframe for CEModeB in TS 36.211 Huawei, HiSilicon
Decision: The CR in R1-167154 is endorsed in principle (further check offline about 36.213 text). Final CR is agreed as CR0281 to 36.211 in R1-168155.

R1-167184 Correction on the reference of narrowband definition in TS 36.213 Huawei, HiSilicon
Decision: CR0698 to 36.213 (Rel-13, F) is agreed.

R1-167187 Correction on the MPDCCH scheduling Paging in special subframe in TS 36.213 Huawei, HiSilicon
Decision: The CR in R1-167187 is endorsed with the following update (final CR to be prepared in R1-168158)
- For TDD, in special subframes, ~~and~~for MPDCCH in Type-1 ~~-~~common search space

R1-167403 Correction on the determination of DL narrowbands for MPDCCH candidates ITRI
R1-167679 Correction on Type0-common search space monitoring in TS 36.213 Huawei, HiSilicon
R1-167680 Correction on indentation in TS 36.211 Huawei, HiSilicon
Continue discussion offline.
Friday
R1-168158 Correction on the MPDCCH scheduling Paging in special subframe in TS 36.213 Huawei, HiSilicon
Decision: CR0724 to 36.213 (Rel-13, F) is agreed.

PDSCH
R1-166234 CR for PDSCH scrambling for SIQualcomm Incorporated
R1-167186 Correction on the scrambling initialization for SIB1-BR/SI for eMTC in TS 36.213 Huawei, HiSilicon
Decision: The CR in R1-167186 is endorsed in principle (further discuss offline about the wording), and final CR is agreed as CR0700 to 36.213 (Rel-13, F) in R1-168157.

R1-166235 Draft CR for P-RNTI PDSCH hopping Qualcomm Incorporated
R1-167849 Frequency hopping for PDSCH for SI and paging messages for BL/CE UE Ericsson
Decision: The CR in R1-167849 is agreed, along with the CR in R1-166235. Revised CR (using R1-167849) to be revisited in R1-167953
Decision: CR0272 to 36.211 (Rel-13, F) is agreed in R1-167953.

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R1-166428 Remaining issues on eMTC CATT (Proposal 1)
R1-167185 Correction on the relationship between IMCS and ITBS for DCI format 6-1A in TS 36.213 Huawei, HiSilicon
Decision: CR0699 to 36.213 (Rel-13, F) is agreed.

R1-167714 RV version for PDSCH carrying paging Nokia, Alcatel-Lucent Shanghai Bell
Decision: Continue offline discussion
Friday:
R1-168359 RV version for PDSCH carrying paging Nokia, Alcatel-Lucent Shanghai Bell
Decision: The CR in R1-168359 is endorsed. Provide a revision with the change tracking on the cover sheet removed in **R1-168399** agreed as CR0729r1 to 36.213 (Rel-13, F).

R1-167856 PDSCH start subframe in TDD for BL/CE UE Ericsson
Decision: The CR in R1-167856 is endorsed by adding a space in between "DL" and "subframe". Final CR is agreed as CR0714r1 to 36.213 (Rel-13, F) in R1-168462.

DL reference signals
R1-167153 Correction on scrambling sequence initialization for reference signals associated with PDSCH and MPDCCH in TS 36.211 Huawei, HiSilicon
R1-167852 Scrambling of DL DMRS for BL/CE UE Ericsson
Decision: CR0275 to 36.211 (Rel-13, F) is agreed.
R1-167861 Enable cross-subframe channel estimation for BL/CE UE Ericsson
Decision: CR0276 to 36.211 (Rel-13, F) is agreed.

CSI
R1-166240 Draft CR for subband CQI report without hopping Qualcomm Incorporated
Decision: Continue offline discussion
Friday: No progress – continue discussion at next meeting.

R1-166241 Draft CR for subband CQI report and TM6 Qualcomm Incorporated
Decision: The CR in R1-166241 is endorsed, and final CR is agreed as CR0215 to 36.212 (Rel-13, F) in 1-168287.
R1-167857 Repetition with aperiodic CSI for BL/CE UE Ericsson
Decision: Continue offline discussion especially regarding whether or not UCI is transmitted in the same set of subframes for PUSCH transmission. Finally CR0715 to 36.213 (Rel-13, F) is agreed.

PUSCH
R1-166683 Draft CR on RV Cycling for PUSCH Samsung
Decision: Further discussion offline, including PDSCH aspects
The CR in R1-168161 is endorsed with the superscript PUSCH corrected to PDSCH, and final CR is agreed as CR0732 to 36.213 (Rel-13, F) in R1-168450 (NOTE: MCC will take care of removing "DRAFT" on the cover page)

R1-167311 Draft CR for PUSCH rate matching and SRS dropping Qualcomm Incorporated
Decision: Further discussion offline
Conclusion:
- The principle in R1-167311 is aligned with RAN1 understanding. No CR is necessary.

PUCCH
R1-166242 Draft CR for PUCCH transmission and invalid subframes Qualcomm Incorporated
Decision: Further discussion offline. Finally CR is agreed as CR0737 to 36.213 (Rel-13, F) in R1-168521.
R1-166243 Draft CR for aperiodic CSI with repetitions Qualcomm Incorporated
R1-166244 Draft CR for PUCCH resource allocation Qualcomm Incorporated
Decision: The CR in R1-166244 is endorsed, and final CR is agreed as CR0728 to 36.213 (Rel-13, F) in R1-168519.
R1-167858 PUCCH resource start offset in RRC_CONNECTED for BL/CE UE Ericsson
R1-166428 Remaining issues on eMTC CATT (Proposal 2)
R1-167677 Correction on the PUCCH transmission in TS 36.211 Huawei, HiSilicon
R1-167864 Default UL frequency hopping interval for PUCCH for BL/CE UE Ericsson
Decision: Further discussion offline

UL frequency retuning
R1-166498 On timeline issues with shortened PUCCH format Qualcomm Incorporated
R1-166630 Simulation results for PUCCH frequency retuning NEC
R1-166684 PUCCH Structure for Frequency Retuning Samsung
R1-167848 PUCCH frequency retuning for BL/CE UE Ericsson

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Further discussion offline

Further in the week:
R1-168461 WF on PUCCH retuning for BL/CE UE Ericsson
R1-168465 Operation Alternatives for PUCCH Retuning Samsung
R1-168514 WF on PUCCH retuning for BL/CE UE Ericsson, Samsung, NEC, Qualcomm, Virtuosys, Sony, Sierra Wireless, NTT DoCoMo, AT&T, Intel
Also supported by Verizon

Agreements:
- PUCCH retuning gap for BL/CE UEs is created through puncturing
- RAN1 would discuss the possibility to have 1-bit signalling for PUCCH puncturing vs. PUCCH rate matching for PUCCH retuning in Rel-14

The corresponding CR to be drafted for email approval until 9/2 – (Ericsson)

Random access
R1-166232 Draft CR for clarification on PRACH system frame number Qualcomm Incorporated
Decision: Further discussion offline. Finally CR is agreed as CR0285 to 36.211 (Rel-13, F) in R1-168508.
R1-166233 Draft CR for overriding of valid-invalid mask for msg3 Qualcomm Incorporated
R1-166623 Transport block size determination for Msg2 Sequans Communications
Decision: CR0695 to 36.213 (Rel-13, F) is agreed.
R1-167855 Msg2 TBS determination for BL/CE UE Ericsson
R1-166624 eMTC corrections for RAN1 specifications Sequans Communications (Sections 5 and 7)
R1-167157 Correction on the determining PRACH starting subframe in TS 36.211 Huawei, HiSilicon
Decision: Further discussion offline
R1-167718 Overriding of invalid subframe for msg3 PUSCH when R=1 Nokia, Alcatel-Lucent Shanghai Bell
Decision: CR in R1-167718 is endorsed with the following update (final CR to be prepared in R1-168424).
- When ~~value of is~~ the number of Msg3 PUSCH repetitions

Decision: CR0722r1 to 36.213 (Rel-13, F) is agreed in R1-168424.

R1-167853 Default max number of PUSCH repetitions for Msg3 for BL/CE UE Ericsson
Decision: Further discussion offline. Finally CR0711 to 36.213 (Rel-13, F) is agreed.

R1-167940 Correction for UL grant size in RAR Sequans Communications
Late submission
Decision: Further discussion offline.
The CR in R1-167940 is agreed in principle but should be based on 36.213 V13.2.0. Revised and agreed **R1-168513** (CR0720r1 to 36.213).

R1-167909 Frequency hopping interval for MPDCCH during random access for BL/CE UE Ericsson
Late submission
Decision: Further discussion offline. Finally CR0278 to 36.211 (Rel-13, F) is agreed.

Collisions
R1-166619 MPDCCH collision with PSS/SSS Sequans Communications
Conclusion:
- The principle in R1-166619 is aligned with RAN1 understanding. No CR is necessary

R1-166620 MPDCCH mapping over reserved CRS tones in PBCH subframes Sequans Communications
Decision: Further discussion offline.
Conclusion:
- The principle in R1-166620 is aligned with RAN1 understanding. No CR is necessary.

R1-166624 eMTC corrections for RAN1 specifications Sequans Communications (Sections 2 and 4)
R1-166659 Simultaneous transmission & reception in HD-FDD Sony
Conclusion:
- Proposal 1 in R1-166659 is aligned with RAN1 understanding. No CR is necessary.

R1-167156 Clarification on collision between SR and PDSCH with repetitions in TS 36.213 Huawei, HiSilicon
Decision: Further discussion offline.

7.1.6 Maintenance of Release 13 NB-IoT
R1-168401 Chairman's notes of AI 7.1.6 on Maintenance of Release 13 NB-IoT Ad-Hoc chair (Qualcomm)

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The document was presented by Wanshi Chen from Qualcomm.
Decision: The document is endorsed and content is incorporated as follows.

DL Common Channels
R1-166247 Draft CR for N_SF value for SI Qualcomm Incorporated
R1-166197 Corrections on NPDSCH related procedure in TS 36.213 Huawei, HiSilicon
Decision: The CR in R1-166197 is endorsed in principle. Refined text for the last change. Revised and agreed as CR0692r1 to 36.213 (Rel-13, F) in R1-167990.
R1-166642 Missing definition of higher layer parameter eutra-CRS-SequenceInfo NEC
R1-167783 Corrections on Narrowband reference signal (NRS) in TS 36.211 Ericsson
Decision: Agree in principle to capture eutra-CRS-SequenceInfo related information in 36.213. Further discussion offline on the details. To be revisited in final CR in R1-168319 (NEC)
Friday:
R1-168319 Missing definition of higher layer parameter eutra-CRS-SequenceInfo NEC
Decision: Final CR is agreed as CR0730 to 36.213 (Rel-13, F) in R1-168374.

R1-167178 Corrections on the presence of NRS for standalone and guard band operation mode in TS 36.211 Huawei, HiSilicon
Also supported by Qualcomm, Intel
R1-167437 Clarification of NRS assumption Panasonic Corporation
Also supported by ZTE, Ericsson, DCM, Nokia, ASB, Samsung, LGE
Decision: Continue discussion offline
R1-168444 Corrections on the presence of NRS for standalone and guard band operation mode in TS 36.211 Huawei, HiSilicon
Decision: CR0263 to 36.211 (Rel-13, F) is agreed.
R1-168238 Clarification of valid NB-IoT DL subframe configuration Samsung , Panasonic
R1-168516 Clarification of NB-IoT DL subframe configuration Huawei, HiSilicon
Decision: The CR in R1-168516 is endorsed, revised in:
R1-168539 Clarification of NB-IoT DL subframe configuration Huawei, HiSilicon
Decision: CR0739 to 36.213 (Rel-13, F) is agreed.

R1-167166 Correction on NPBCH in TS 36.211 Huawei, HiSilicon
Decision: CR0260 to 36.211 (Rel-13, F) is agreed.
R1-167183 Correction on BCH rate matching in TS 36.212 Huawei, HiSilicon
Decision: CR0211 to 36.212 (Rel-13, F) is agreed.
R1-167174 Correction on NPSS mapping in TS 36.211 Huawei, HiSilicon, Rohde & Schwarz
Decision: Continue discussion offline
Friday:
R1-168293 Correction on NPSS mapping in TS 36.211 Huawei, HiSilicon, Rohde & Schwarz
Decision: CR0262r1 to 36.211 (Rel-13, F) is agreed.

LS received during RAN1#86
R1-168340 LS on applicability of NRSRQ measurement RAN4, Huawei
R1-168296 Correction on NRSRQ applicability Huawei, HiSilicon
Decision: CR0037 to 36.214 (Rel-13, F) is agreed.

Antenna Ports
R1-167435 Correction of NB-IoT antenna port mapping Panasonic, Huawei, HiSilicon, NEC, MediaTek
Decision: The CR in R1-167435 is endorsed in principle. Further re-wording offline. Final CR is agreed as CR0284 to 36.211 (Rel-13, F) in **R1-168236**.
R1-167436 Quasi-colocation of NB-IoT antenna portsPanasonic, Huawei, HiSilicon
Decision: The CR in R1-167436 is endorsed with change from section 16.6 to 16.7. Further re-wording offline. Final CR is agreed as CR0726 to 36.213 (Rel-13, F) in **R1-168237**

Further discussion offline whether antenna port in 36.214 needs to be clarified or not (Panasonic)
Friday:
R1-168199 Correction on NRS port number mappingHuawei, HiSilicon, Panasonic, Samsung
Decision: CR0036 to 36.214 (Rel-13, F) is agreed.

NPDCCH
R1-166184 Correction on NPDCCH related procedure on TS 36.213 Huawei, HiSilicon
Decision: CR0690 to 36.213 (Rel-13, F) is agreed.

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- Note: the gap includes the one under the sentence "If NPUSCH UL Gap is inserted at the end of NPUSCH transmission"

R1-166499 **Draft CR on parameters for NPDCCH order** **Qualcomm Incorporated**
Decision: Further discussion offline, including the change from N0 to N1, whether or not N-PDCCH order is used or not, whether or not a mapping table is used, and "repetition level" to "repetition #", whether or not the necessity of last sentence
Decision: No CR is necessary.

R1-167312 Draft CR about Correction on PDCCH order related description ZTE
R1-167176 **On NPDCCH scrambling** **Huawei, HiSilicon**
R1-167179 Corrections on NPDCCH scrambling in TS 36.211 Huawei, HiSilicon
Withdrawn

R1-167419 **Corrections on NPDCCH scrambling in TS 36.211 Huawei, HiSilicon, Intel, Neul, Qualcomm**
Also supported by MTK
Decision: CR0265 to 36.211 (Rel-13, F) is agreed.
R1-167188 **Corrections on NPDCCH search space for random access in connected mode in TS 36.213 Huawei, HiSilicon**
Decision: CR0701 to 36.213 (Rel-13, F) is agreed.

NPDSCH
R1-167313 Draft CR on clarification of scheduling delay ZTE
Decision: The CR of the first change of 16.3.3 in R1-167313 is endorsed. Final CR is agreed as CR0734 to 36.213 (Rel-13, F) in R1-168496.
R1-167782 Corrections on DL Gap on NPDSCH TS 36.211 Ericsson
Decision: Further discussion offline
R1-167438 Clarification of valid NB-IoT DL subframe configuration Panasonic Corporation
Decision: Further discussion offline

PUSCH
R1-166180 **Correction on DMRS for NB-IoT in TS 36.211** **Huawei, HiSilicon**
R1-167314 **Draft CR on clarification of DM RS** **ZTE**
Decision: Further discussion offline on R1-166180 and R1-167314.
CR0253 to 36.211 (Rel-13, F) is agreed in R1-166180.

R1-166182 **Correction on SC-FDMA signal generation for NB-IoT in TS 36.211** **Huawei, HiSilicon**
Decision: CR0255 to 36.211 (Rel-13, F) is agreed.
R1-166641 Correction to SC-FDMA baseband signal generation for NB-IoT NEC
R1-166245 **Draft CR for PUSCH timing delay for NB-IoT** **Qualcomm Incorporated**
Decision: Further discussion offline.
The CR in R1-166245 is endorsed. Final CR is agreed as CR0731 to 36.213 (Rel-13, F) in R1-168375.

R1-167172 **Correction on NPUSCH related procedure on TS 36.213** **Huawei, HiSilicon**
Decision: CR0696 to 36.213 (Rel-13, F) is agreed.
R1-167316 **Remaining issue on collision of NPUSCH and NPRACH** **ZTE**
R1-167173 **Correction on UL collisions in TS 36.211** **Huawei, HiSilicon**
Decision: The CR in R1-167173 is endorsed in principle. Offline discussion on refined wording (including whether possible LS to RAN2 and RAN4). Revised and agreed as CR0261r1 to 36.211 (Rel-13, F) in **R1-167991**.

NPRACH
R1-166181 **Correction on NPRACH in TS 36.211** **Huawei, HiSilicon**
Decision: Revised and agreed as CR0254r1 to 36.211 (Rel-13, F) in R1-168364.
R1-166248 **Draft CR for NPRACH generation** **Qualcomm Incorporated**
R1-167315 **Draft CR on clarification of random access signal generation** **ZTE**
R1-167838 **Corrections on NPRACH generation TS 36.211** **Ericsson**
Decision: Offline discussion for the above 4 CRs. To have a single final CR to be revisited in R1-168364.

R1-166183 **Correction on random access procedure for NB-IoT on TS 36.213** **Huawei, HiSilicon**
Decision: The CR in R1-166183 regarding section 16.3.2 is endorsed. Final CR is agreed as CR0689r1 to 36.213 (Rel-13, F) in R1-167989.

R1-168172 **Introduction of a reserved range of NPRACH sub-carriers for contention based access, Ericsson, ZTE, Qualcomm**

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Decision: The CR in R1-168172 is endorsed in principle, conditional on RAN2 approval of 36331CR2334. Remove the comment, and showing change tracking for deletion and insertion of equation. Final CR is agreed as CR0282r1 to 36.211 (Rel-13, F) in R1-168495.

Other UL

R1-166246 Capability for NB-IoT uplink gaps Qualcomm Incorporated
Decision: Further discussion offline

R1-167317 Remaining power control issue on multiple NB-IoT carriers operation ZTE
Decision: Further discussion offline

R1-168284 WF on signaling of nrs-Power of non-anchor carrier ZTE, Qualcomm,Panasonic
Agreement:

- nrs-Power offset of non-anchor PRB relative to nrs-Power of anchor PRB should be included in RRC signaling.
- Send LS to RAN2 – R1-168474
  - {-12, -10, -8, -6, -4,-2, ~~-1~~, 0, 3}

R1-168474 LS on nrs-Power signaling for NB-IoT non-anchor carrier ZTE
Decision: The document is noted and final LS is agreed in R1-168497 including the above update.

RRC Parameters

R1-166195 Corrections to RRC parameter names for NB-IoT in TS 36.211 Huawei, HiSilicon
Decision: CR0256 to 36.211 (Rel-13, F) is agreed.

R1-166196 Corrections to RRC parameter names for NB-IoT in TS 36.213 Huawei, HiSilicon
Decision: CR0691 to 36.213 (Rel-13, F) is agreed.

R1-167911 Phase difference between NRS and CRS Qualcomm Incorporated
Late submission
Decision: Further discussion offline

R1-168358 Phase difference between NRS and CRS Qualcomm Incorporated
Decision: The draft CR in R1-168358 is endorsed in principle, adding a note about overlap with LTE baseband signal generation sections. Final CR is agreed as CR0735 to 36.213 (Rel-13, F) in R1-168507.
Note: this CR is not intended to change legacy LTE signal generation.

7.2 LTE Release 14

7.2.1 Enhanced Licensed-Assisted Access to Unlicensed Spectrum WID in RP-160881.

R1-168402 Chairman's notes of AI 7.2.1 on Enhanced Licensed-Assisted Access to Unlicensed Spectrum Ad-Hoc chair (Nokia, Ericsson)

Contents incorporated below

Editors will provide updated draft CRs including the agreements and WA until 6th Sep., and email approval until 12th Sep.
Rapporteur will provide agreement lists until 29th August.

R1-166224 Introduction of eLAA into 36.212 HuaWei Technologies Co., Ltd
R1-167551 Introduction of eLAA Ericsson

7.2.1.1 PUSCH design

Remaining details including PUSCH structure, resource allocation and scheduling aspects

R1-166123 PUSCH resource allocation Huawei, HiSilicon
R1-167776 Resource Allocation with Minimal Predefined Patterns for eLAA PUSCH KT Corp.
R1-166249 Remaining details of PUSCH waveform Qualcomm Incorporated

R1-167074 On Two-Stage UL scheduling for eLAA Nokia, Alcatel-Lucent Shanghai Bell

R1-166251 PUSCH and eLAA procedures Qualcomm Incorporated

R1-167344 Discussion on power headroom report and buffer status report enhancement for eLAA NTT DOCOMO, INC.

R1-166124 Enabling transmissions within the first SC-FDMA symbol in a subframe Huawei, HiSilicon

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R1-166137 Two-stage scheduling for eLAA Huawei, HiSilicon
R1-166250 TBS selection for PUSCH for multi-TTI grants Qualcomm Incorporated
R1-166252 Control details for UL scheduling Qualcomm Incorporated
R1-166253 Remaining details of DCI and UL search space design Qualcomm Incorporated
R1-166504 PUSCH resource allocation method Intel Corporation
R1-166505 Indication of the starting PUSCH DFT-S-OFDM symbols Intel Corporation
R1-166506 Remaining issues with PUSCH structure Intel Corporation
R1-166631 Remaining issues on PUSCH resource allocation NEC
R1-166667 eLAA PUSCH transmission Fujitsu
R1-166685 Remaining issues on PUSCH design for eLAA Samsung
R1-166686 PUSCH Scheduling and Resource Allocation Samsung
R1-166814 Remaining issues on PUSCH transmission in LAA LG Electronics
R1-166815 Remaining issues on DCI formats for UL scheduling in LAA LG Electronics
R1-166987 Remaining details of PUSCH design for eLAA ZTE
R1-167024 PUSCH resource allocation details Nokia, Alcatel-Lucent Shanghai Bell
R1-167026 Remaining Issues on LAA SCell PUSCH Transmit Power Nokia, Alcatel-Lucent Shanghai Bell
R1-167073 On remaining scheduling aspects for eLAA Nokia, Alcatel-Lucent Shanghai Bell
R1-167075 On eLAA UE blind decoding capabilities Nokia, Alcatel-Lucent Shanghai Bell
R1-167133 Special handling of MCS/TBS for normal PUSCH and the PUSCH containing UCI/SRS/blanking symbol(s) Huawei, HiSilicon
R1-167182 Remaining issues on scheduling design for eLAA Huawei, HiSilicon
R1-167190 Discussion on synchronous and asynchronous HARQ method for eLAA Huawei, HiSilicon
R1-167343 Remaining details on PUSCH resource allocation and scheduling design for eLAA NTT DOCOMO, INC.
R1-167420 MCS, TBS and TPMI Determination in Single and Multi-Subframe Grants Panasonic
R1-167421 Codeword Disabling for eLAA Uplink MIMO Panasonic
R1-167605 Remaining details on DCI design for multiple-subframe scheduling for LAA UL SHARP Corporation, MTI
R1-167606 Remaining details on PUSCH structure for LAA UL SHARP Corporation
R1-167719 On PUSCH Structure for Transmission within First DFTS-OFDM Symbol Ericsson
R1-167720 On Resource Allocation Aspects for eLAA Ericsson
R1-167721 On Remaining details of Scheduling Aspects for eLAA Ericsson
R1-167734 Indication of starting symbol for multi-subframe scheduling ETRI
R1-167776 Resource Allocation with Minimal Predefined Patterns for eLAA PUSCH KT Corp.

Agreement:
For enabling the start times within the first DFTS-OFDM symbol, a longer cyclic prefix for the next DFTS-OFDM symbol to occupy part of the first DFTS-OFDM symbol is used

Agreement:
- RA field in DCI 0A/4A/0B/4B is 6 bits
- The 64 code points indicated by the 6 bits include the legacy RIV for contiguous interlace allocation except the code points for the allocation of 7 contiguous interlaces (70 PRBs)
  - This set of code points has 51 values
- Additional code points are defined for allocation of interlaces as follows:
  - 0,1,5,6
  - 2,3,4,7,8,9
  - 0, 5
  - 1, 6
  - 2, 7
  - 3, 8
  - 4, 9
  - 1, 2, 3, 4, 6, 7, 8, 9
  - Remaining code points are reserved

Agreement:
One of four starting symbol positions can be signaled for the first subframe in DCI formats 0A/4A/0B/4B

Agreement:
LBT type is not explicitly signaled to the UE for SRS without PUSCH.

Agreement:
- MCS 0-28 indicated to the UE in DCI formats 0A/4A/0B/4B are interpreted according to the uplink MCS table for modulation and TBS
- RV is explicitly signaled for all MCSs.

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Agreement:
- TB disabling is indicated if MCS 29 is indicated for the corresponding TB in DCI formats 4A/4B.
  - The disabling applies for all scheduled subframes for DCI format 4B

Agreement:
- An aperiodic CSI report without UL-SCH is triggered when the UE receives DCI formats 0A/0B with MCS 29 and an aperiodic CSI trigger
- An aperiodic CSI report without UL-SCH is triggered when the UE receives DCI formats 4A/4B with MCS 29 for both TBs and an aperiodic CSI trigger
- UE is not expected to receive an aperiodic CSI only request if more than one subframe is scheduled with DCI formats 0B/4B

Agreement:
- 4 bits for timing offset are included in DCI format 0A/4A
  - Note: This is already agreed for DCI format 0B/4B
- DCI format 0A/4A includes 4 bits indicating HARQ process ID
  - Note: This is already agreed for DCI format 0B/4B
- DCI format 0A includes 2 bits RV indicating RV=0, 1, 2, or 3
- DCI format 4A includes 2 bits RV indicating RV=0, 1, 2 or 3 which is common to both TBs

Agreement:
- For each DCI format 0B, 4A and 4B the following BD adjustment is applied
  - (0, 33, 66, 100)% for 1st and 2nd AL and (0, 50, 100, 150)% for 3rd to 5th AL

Agreement:
If not otherwise indicated by the RRC parameter supportedBlindDecoding-r13, the eNB can assume the total number of supported blind decodes to be #CCs_supported*32+#CCs_UL_TM2_supported*16 USS BDs

- SRS triggering offset in format 0B/4B (Klaus)

R1-168028 WF on SRS triggering with DCI Format 4B Nokia, ASB

Agreement:
- For SRS triggered with DCI format 4B, the SRS subframe location is determined relative/as an offset n to the first subframe of the multi-subframe scheduling burst according to

  $n = mod(x, N)$

  where x is the value of the SRS subframe indication in the SRS parameter set configuration ($x \in \{0,1,2,3\}$) and N is the number of scheduled UL subframes.

Agreement:
Precoder indicator field in DCI format 4B applies to all the subframes in the DCI
  - Mapping to number of layers and TPMI is the same as DCI format 4

A single DMRS and OCC field is signaled for all subframes indicated in DCI formats 0B/4B
- The parameter n^(2)_DMRS,Lambda applies to all indicated subframes

Agreement:
The UE is not expected to start a new transmission subject to LBT earlier than 1 DFTS-OFDM symbol after the end of the previous transmission by the UE

Agreements:
- C-PDCCH indicates a pair of values (UL burst duration, offset)
  - UL burst duration is the number of consecutive UL subframes belonging to the same channel occupancy, with the DL subframes in the same channel occupancy signaling the UL burst duration.
  - Offset is the number of subframes to the start of indicated UL burst from the start of the subframe carrying the C-PDCCH.
  - The LBT procedure for any UL subframe from the subframe in which C-PDCCH was received upto and including all subframes until the end of the signaled UL burst duration, for which the eNB had already indicated to perform Category 4 LBT, can be switched to an LBT based on 25 us CCA.
    - The UE shall not switch to 25 us CCA if only part of a set of contiguously scheduled subframes without gap appears in the UL burst indication
  - The UE is not required to receive any DL signals/channels in a subframe indicated to be a UL subframe on the carrier

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- 5 bits to indicate combinations of offset and burst duration.
  - The code points include {offset, duration} combinations as follows
    - All combinations of {{1, 2, 3, 4, 6}, {1, 2, 3, 4, 5, 6}}
    - Reserved
    - No signaling of burst and offset

Agreements:

- DCI 0A/4A/0B/4B includes a single bit to indicate whether the UL grant is a triggered grant or not.
- If it is a triggered grant, the UE may transmit after receiving a 1 bit trigger in the PDCCH DCI scrambled with CC-RNTI in a subframe received after the subframe carrying the UL grant
- The timing between the 2nd trigger transmitted in subframe N and the earliest UL transmission is a UE capability, if the earliest UL transmission is before subframe N+4 (UE capability signaling between transmission in subframe N+1 and N+2 and N+3)
- The 4 bit field 'SF timing' in DCI format 0A/4A/0B/4B for the triggered grant is reused as follows:
  - When the UE may transmit after reception of the trigger is signaled to the UE 2 bits are reused to indicate X:
    - Having received a trigger in subframe N, the UE is allowed to start transmission in subframe N+X+Y
      - X={0,1,2,3} indicated reusing two bits in the DCI
      - Y is given by the UL burst offset in the C-PDCCH DCI scrambled by CC-RNTI in the same subframe where the trigger is transmitted
  - The UE receives signaling in the first DCI 0A/4A/0B/4B grant indicating the number of subframes after which the grant becomes invalid reusing 2bits. The initial grant becomes invalid if M ms after the initial grant, no valid trigger has been received.
    - 2 bit: M={8,12,16,20}
- UE follows the LBT type indicated by the UL grant

Agreements:

- When CSI report is triggered using DCI 0A/4A/0B/4B, the reference subframe is the last valid subframe with reference to the subframe in which the CSI report is transmitted
- Note: This may not need any specification change

Agreements:

- DCI formats 0A and 1A which are transmitted in the same serving cell and that schedule the same serving cell shall have the same sizes. Bit padding is used to achieve this.

7.2.1.2 SRS design

Remaining details including whether SRS is transmitted for small gaps between SRS and following PUSCH

R1-166136	Remaining issues on LBT for SRS for eLAA	Huawei, HiSilicon
R1-166254	SRS procedures for eLAA	Qualcomm Incorporated
R1-166663	LBT parameters for SRS in eLAA	Sony
R1-166687	Remaining issues of SRS transmission followed by PUSCH	Samsung
R1-166816	Consideration on SRS and following PUSCH	LG Electronics
R1-166988	Remaining details of SRS design for eLAA	ZTE
R1-167625	On the Subframe Indication in SRS Triggering in eLAA	Nokia, Alcatel-Lucent Shanghai Bell
R1-167722	On the Minimum Gap between SRS and PUSCH Transmissions	Ericsson

Agreement (Update of previous agreements: (RAN1#85 Email discussion [85-05-04]))

- If the triggering for SRS without PUSCH is received in a DL assignment in subframe n, the UE should send SRS without PUSCH in subframe n+k (not considering the LBT failure).
  - The SRS transmission is not limited to DL ending partial subframe
- k is indicated by 3 bits in DL grant. "000" represents no triggering for SRS without PUSCH; "001"~"111" represents SRS without PUSCH is transmitted in subframe n+4~n+10 respectively.

7.2.1.3 Channel access framework

Remaining details including LBT options for SRS not immediately followed by PUSCH, contention window size adjustment for UL Category 4 LBT, continuing transmission of continuously scheduled subframes, energy detection threshold, LBT related signaling aspects and revised and 2-stage grants.

R1-166134	Signaling for UL LBT parameters for eLAA	Huawei, HiSilicon
R1-166135	Contention window size adjustment for UL category 4 LBT for eLAA	Huawei, HiSilicon
R1-166255	Remaining details of UL LBT	Qualcomm Incorporated

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R1-166507 Remaining details of the UL channel access mechanism Intel Corporation
R1-166508 Necessary modifications to existing Logical Channel Prioritization mechansim Intel Corporation
R1-166688 Remaining issues on CWS adjustment for Cat 4 LBT Samsung
R1-166689 Remaining issues of LBT for SRS Samsung
R1-166690 Remaining issues of LBT signalling Samsung
R1-166691 Discussion on two-step UL grant scheduling Samsung
R1-166817 CWS adjustment for LAA LG Electronics
R1-166818 LBT parameter signalling in LAA LG Electronics
R1-166819 Remaining details on UL LBT for LAA LG Electronics
R1-166989 Remaining details of LBT Design for eLAA ZTE
R1-167132 Discussion on UL multi-carrier LBT for eLAA Huawei, HiSilicon
R1-167196 Channel acess scheme for UE multiplexing Kyocera Corporation
R1-167345 Remaining details on channel access framework for eLAA NTT DOCOMO, INC.
R1-167509 Remaining issues of LBT mechanism for LAA uplink Lenovo (Beijing) Ltd
R1-167607 Remaining details on channel access framework for LAA UL SHARP Corporation
R1-167626 Remaining Issues on Channel Access for LAA UL Nokia, Alcatel-Lucent Shanghai Bell
R1-167627 Multi-Carrier Channel Access for LAA UL Nokia, Alcatel-Lucent Shanghai Bell
R1-167692 Common PDCCH design Intel Corporation
R1-167723 On Contention Window Adjustment for Category 4 UL LBT Ericsson
R1-167724 Additional Evaluations for eLAA Ericsson
R1-167725 Energy Detection Threshold for eLAA Ericsson
R1-167726 On Reported RSSI from Wi-Fi Devices Ericsson
R1-167727 On Continuous Transmission for Consecutive Scheduled UL Subframes Ericsson
R1-167728 On LBT Related Signaling for eLAA Ericsson
R1-167729 On Remaining LBT details for Transmission of SRS without PUSCH Ericsson
R1-167731 Discussion on overlapping of LBT procedures HTC Corporation
R1-167735 CWS adjustment mechanism for CAT 4 UL LBT in eLAA ETRI
R1-167736 Remaining details of SRS LBT for eLAA ETRI
R1-167769 Considerations for the Cat 4 CW size adjustment Sequans Communications
R1-167780 Contention Window adaptation procedure for Uplink CAT 4 LBT in eLAA BROADCOM LIMITED
R1-167781 Details of Cat 4 LBT procedure for eLAA Uplink BROADCOM LIMITED
R1-167786 Discussion on Modifying UL LBT Type WILUS Inc.
R1-167787 Indication of Reference Subframe for CW adjustment WILUS Inc.
R1-167788 UL Multi-carrier Transmission for eLAA WILUS Inc.
R1-167793 Discussion on LBT for aperiodic SRS transmissions not multiplexed with PUSCH BROADCOM LIMITED
R1-167800 Handling of transmission errors in case of consecutively scheduled Uplink subframes in eLAA BROADCOM LIMITED

R1-168078 WF on multi-carrier UL LBT operation Huawei, HiSilicon

Agreement:

- A UE that has received UL grants on a set of carriers scheduled with Cat. 4 LBT with the same starting point in the subframe on all carriers can switch to a 25 us LBT immediately before transmission on a carrier in the set if Cat. 4 LBT has successfully completed on a designated carrier in the set.
  - The UE must select one carrier uniformly randomly among the carriers which were scheduled with Cat. 4 LBT as the designated carrier prior to starting the Cat. 4 LBT procedure on any of the carriers in the set.
- Note: if operating in the 5GHz band, refer to the ETSI regulations w.r.t. choosing the set of carriers.

Agreements:

- When the UE is scheduled two sets of UL subframes with Cat. 4 LBT, with two different UL grants and the Cat. 4 LBT does not complete for transmission of any of the subframes in the first set of UL subframes, then the Category 4 LBT for the second set of UL subframes is performed as follows
  - If the LBT priority class of the second set of UL subframes is the same as the first set of UL subframes, the UE may continue the Cat. 4 LBT for the first set of subframes for transmission of the second set of UL subframes
  - If the LBT priority class of the second set of UL subframes is different from the first set of UL subframes
    - If the LBT priority class of the second set of UL subframes(e.g. Class 1) is higher than the priority class of the first set of UL subframes (e.g., Class 3), the UE may terminate the previous Cat. 4 LBT and start a new Cat. 4 LBT
    - If the LBT priority class of the second set of UL subframes (e.g., Class 3) is lower than the priority class of the first set of UL subframes (e.g., Class 1), the UE shall terminate the previous Cat. 4 LBT and start a new Cat. 4 LBT

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- Note: If the UE continues Cat. 4 LBT, it shall use all the Cat. 4 LBT parameters that were used for the first set of subframes

R1-168165 WF on UE PSD restriction in eLAA

R1-168181

Agreement:
- For LBT for SRS not transmitted contiguously with PUSCH, a Cat. 4 LBT with priority class 1 is used.
- SRS transmissions do not contribute to the contention window update.

Agreement (Update of previous agreement)
- ~~FFS:~~ For a set of consecutive scheduled subframes without any gaps that are subject to LBT, after the first successful LBT in that set, the UE continues transmission for all the remaining subframes in the set.
  - FFS: Early termination of the channel occupancy

Agreement:
For category 4 LBT for PUSCH transmission on LAA SCell, the CWS is adjusted per UE and at UE based on the following procedures at UE and eNB:
- If the UE fails to transmit all of the scheduled contiguous subframes with a category 4 LBT, UE may keep the contention window size unchanged for all the LBT priority classes.
- The first subframe with UL-SCH that was transmitted at least 4 ms prior to the UL grant reception in the most recent transmitted burst of contiguous subframes that is transmitted after performing a category 4 LBT procedure is defined as the reference subframe. The HARQ ID of the reference subframe is HARQ_ID_ref.
- Based on the UL grant content
  - if the NDI bit for at least one of the active HARQ processes (i.e. TB not disabled) of HARQ_ID_ref in the reference subframe is toggled, the contention window size at the UE is reset for all the priority classes.
  - Otherwise (i.e. HARQ_ID_ref not scheduled or NDI of the active HARQ process(es) of HARQ_ID_ref not toggled) the contention window size of all priority classes at the UE is increased to the next higher value.
- The CWS is reset to the minimum value if the maximum CWS is used for K consecutive LBT attempts for transmission only for the priority class for which maximum CWS is used for K consecutive LBT attempts.
  - K is selected by UE implementation from the set of values from (1, …,8).

Agreement:
- The maximum energy detection threshold requirement for a UE is aligned with the requirement for an eNB as specified in Rel-13
- The eNB can signal a RRC parameter to the UE so that the UE can derive a maximum energy detection threshold value.
  - If no RRC signalling is received, the UE uses a default maximum energy detection threshold value, X_Thresh_Max, as defined in Rel-13, using Pc_max_H,c for P_TX in the calculation of X_Thresh_Max

Agreement:
- RRC signaling has the ability to indicate to a UE either an absolute maximum energy detection threshold value or an offset to the default maximum energy detection threshold value
- Absolute maximum energy detection threshold values are indicated in the range of -85 dBm to -52 dBm in steps of 1 dB.
- Offset to the default maximum energy detection threshold value are indicated in the range of -13 dB to +20 dB in steps of 1 dB.
- Note: Ability to signal a certain maximum energy detection threshold does not indicate feasibility of operating at that threshold value.

R1-168345 [Draft]LS on further RRC Parameters for Enhanced LAA for LTE,
Agreed in R1-168346

Agreement:
The UE is not required to consider LBT success or failure on the set of carriers on which transmission is attempted in order to apply power scaling rules for that set of carriers

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Agreement:
If the UE starts a contiguous transmission spanning a set of subframes on an LAA SCell, and the UE suspends transmission prior to the last scheduled subframe in the transmission, then the UE may resume transmission on the remaining subframes in the transmission immediately after performing an LBT of duration 25 microseconds if the channel was observed to be continuously idle since the transmission was suspended. If the channel was not observed to be continuously idle, then the UE may resume transmission after performing a successful Cat. 4 LBT with LBT parameters according to the indicated LBT priority class in the UL grant that scheduled the subframe in the transmission.

Agreement:
The UE may expect an LBT priority class field in a UL grant regardless of the LBT type indicated to the UE in the UL grant. If 25 us LBT is indicated as the LBT type, then the LBT priority class is the one used by the eNB to obtain access to the channel. If Cat. 4 LBT is indicated as the LBT type, then the LBT priority is the one that is to be used by the UE to perform its Cat. 4 LBT.

Agreement:
If the eNB schedules UL transport blocks with 25 us LBT in a shared channel occupancy without scheduling any DL transport blocks and if less than 10% of the scheduled UL transport blocks have been received successfully, the eNB increases its contention window size, otherwise the eNB resets its contention window.

Agreement:
- An eNB starting the DL transmission based on Type B multi-carrier LBT acquiring a given MCOT, can share its channel occupancy with its UEs on each of the carriers completing 25us LBT in the DL, if the UL transmission follows the previous subframes (DL transmission or UL transmission from other UEs on the same carrier) with a gap of not more than 25us and a successful 25us UL LBT is performed by the UE within the gap

7.2.1.4 Others

R1-166820 UCI transmission for LAALG Electronics
R1-167025 Initialisation of sTAG with eLAA SCells Nokia, Alcatel-Lucent Shanghai Bell

7.2.2 Support for V2V services based on LTE sidelink

WID in RP-161272
R1-168403 Chairman's Notes of Agenda Item 7.2.2 on Support for V2V services based on LTE sidelink Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

Editors will provide updated draft CRs including the agreements and WA until 6th Sep., and email approval until 12th Sep. Rapporteur will provide agreement lists until 29th August.

R1-166223 Introduction of V2V into TS36.212 HuaWei Technologies Co., Ltd
R1-167552 Introduction of V2V support Ericsson

R1-168458 36.201CR0016 Introduction of V2V into 36.201 Nokia
Modify section 4.2.1 as follows:
Sidelink transmissions are defined for ProSe Direct Discovery and ProSe Direct Communication between UEs. The sidelink transmissions use the same frame structure as uplink and downlink when the UEs are in network coverage; however, the sidelink transmissions are restricted to a sub-set of the uplink resources. V2X communication between UEs is supported via sidelink transmissions or via the eNB.
Revision in R1-168201.

R1-168100 Summary of Monday V2V offline discussions LG Electronics

R1-168451 Summary of Thursday V2V offline discussions LG Electronics
Agreements:
- Only normal CP is supported in Rel-14 V2V WI.
- For PSCCH DM RS, the proposal in R1-168439 with u = 8

R1-168126 Response LS to Priority for V2V RAN WG2

R1-168245 Draft LS on RAN1 agreements in sidelink-based V2V LG Electronics [RAN WG1]

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Updated in R1-168249. **Approved in R1-168251** with the following change:

- At least when SA and data are transmitted in the same subframe, SA resource should be reselected only when the associated data resource is reselected

R1-168246 Draft LS on L1 parameters for sidelink-based V2V LG Electronics, [RAN WG1]
Approved in R1-168252 with the following change:

- Add the probability p used in Step 3 with the value range [0, 0.2, 0.4, 0.6, 0.8].
- Capture the following in the comments of "Minimum of PSSCH MCS" and "Maximum of PSSCH MCS":
  - Note that the current RAN1 specification does not support 64 QAM in sidelink.
- **Overall Description:**

RAN1 agreed on L1 parameters for LTE_SL_V2V-Core. RAN1 would like to inform RAN2 that the list of agreed L1 parameters is in the attached spreadsheet. Changes to the content of R1-165968 are marked in yellow. RAN1 would like to observe that congestion control and synchronization will be discussed and the outcome may have RRC impact.

R1-168247 Summary of Wednesday V2V offline discussions LG Electronics

7.2.2.1 Remaining details of physical layer structure

Including RS sequence of PSCCH/PSSCH/PSBCH

R1-166164 Details of PSCCH DMRS design Huawei, HiSilicon
R1-166256 Link Level Enhancements for V2V Qualcomm Incorporated
R1-166509 Remaining details of PSCCH and PSSCH physical layer structure for V2V communication Intel Corporation
R1-166510 Remaining details of PSBCH physical layer structure for V2V communication Intel Corporation
R1-166575 Considerations on DMRS Sequence Selection Beijing Xinwei Telecom Techn.
R1-166713 Remaining details on DMRS Samsung
R1-166821 Remaining details on DMRS for PSCCH and PSSCH LG Electronics
R1-166822 Remaining details on DMRS for PSBCH LG Electronics
R1-166823 Remaining issues on physical layer structure for PC5-based V2V LG Electronics
R1-166951 Outstanding Physical Layer Structure Details and Receiver Behavior for Sidelink V2V Ericsson
R1-166959 DMRS design details for PSCCH, PSSCH and PSBCH Ericsson
R1-166976 RS sequence of PSCCH/PSSCH ZTE
R1-167151 Discussion of transmission parameters range of PSSCH Huawei, HiSilicon
R1-167750 DM-RS sequence for PSCCH/PSSCH/PSBCH in V2V Innovative Technology Lab Co.
R1-167863 Considerations on DMRS sequences selection Beijing Xinwei Telecom Techn.

R1-168117 WF on PSSCH DMRS LG Electronics, Huawei, HiSilicon, Nokia
Agreement:

- Destination ID is not signaled via SA.
- 16 CRC bits from SA are used in generating PSSCH DMRS sequence and data scrambling sequence.

R1-168440 WF on PSSCH sequence on V2V LG Electronics, KT, Intel
Agreement:

Petitioners' Exhibit 1007, p. 1653
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Parameter		PSSCH
Group hopping		enabled
	n_{ID}^{RS}	n_X
	n_s	$2n_{ss}^{PSSCH}+k,\ k=0,1$
	f_{ss}	$\lfloor n_X/16 \rfloor \bmod 30$
Sequence hopping		disabled
Cyclic shift	$n_{CS,\lambda}$	$\lfloor n_X/2 \rfloor \bmod 8$
Orthogonal sequence	$[w'(0)\ \ w'(1)\ \ w'(2)\ \ w'(3)]$	$[+1\ \ +1\ \ +1\ \ +1]$ if $n_X \bmod 2 = 0$ $[+1\ \ -1\ \ +1\ \ -1]$ if $n_X \bmod 2 = 1$
Reference signal length	M_{sc}^{RS}	M_{sc}^{PSSCH}
Number of layers	υ	1
Number of antenna ports	P	1

where $r_{PSSCH}^{(\lambda)}(m \cdot M_{sc}^{RS}+n) = w^{(\lambda)}(m) r_{u,v}^{(\alpha_\lambda)}(n),\ m=0,1,2,3$

n_X is X bits in SA to be used in generating PSSCH DMRS sequence.

~~Formula for n_s for group hopping to be confirmed on Friday.~~

7.2.2.2 Remaining details of UE autonomous resource selection mode

R1-166824 System level evaluation results for UE autonomous resource seleciton mode LG Electronics

7.2.2.2.1 Details of transmission resource (re)selection based on SA decoding and power/energy measurement

Including down-selection of the options for sensing and transmission resource selection, considering the working assumption "Priority information in a decoded SCI is used in resource (re)selection"

R1-166169 Details of sensing procedure and resource (re)selection triggering mechanisms Huawei, HiSilicon
R1-166204 Discussion on the remaining issues for priority handling Huawei, HiSilicon
R1-166257 Details of sensing using autonomous resource selection for V2V Qualcomm Incorporated
R1-166429 Discussion on UE autonomous resource selection mechanism in V2V CATT
R1-166511 Sidelink measurements for V2V sensing and resource re-selection procedures Intel Corporation
R1-166512 Transmitter behavior for sidelink resource re-selection Intel Corporation
R1-166714 Details on sensing based resource (re)selection Samsung
R1-166825 Sensing details for UE autonomous resource selection mode in PC5-based V2V LG Electronics
R1-166826 Resource selection details for UE autonomous resource selection mode in PC5-based V2V LG Electronics
R1-166977 SA and data resource (re)selection ZTE
R1-167008 Resource reselection triggers Ericsson
R1-167009 Resource reselection Ericsson
R1-167010 Scheduling over PC5 Ericsson
R1-167013 Subchannelization and measurements for sensing for V2V over PC5 Ericsson
R1-167076 Discussion on triggering resource reselection based on collision detection Sony
R1-167355 Further details of UE autonomous resource (re)selection for V2V NTT DOCOMO, Inc.
R1-167409 Explicit/implicit resource (re)selection based on SA decoding/energy measurement ITRI
R1-167586 Resource selection using SA decoding and energy measurements INTERDIGITAL COMMUNICATIONS
R1-167587 Priority handling for V2V over PC5 INTERDIGITAL COMMUNICATIONS
R1-167693 Design options to support priority for V2V communication Intel Corporation
R1-167694 Discussion on resource selection aspects to support V2V communication with different transmission periodicity Intel Corporation
R1-167834 V2V SA Resource selection PANASONIC R&D Center Germany
R1-167835 Discussion on resource selection and indication in V2V based on sensing PANASONIC R&D Center Germany

Agreement:

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- Step 2: UE excludes resources at least based on SA decoding and additional conditions.
  - When SA and its associated data are transmitted in same subframe, option 2-1 (measure on DMRS of PSSCH) is supported
    - Option 2-1: A resource is excluded if it is indicated or reserved by a decoded SA and PSSCH RSRP in the associated data resource is above a threshold.
      - PSSCH Reference Signal Received Power (PSSCH-RSRP) is defined as the linear average over the power contributions (in [W]) of the resource elements that carry demodulation reference signals associated with PSSCH, within PRBs indicated by the associated PSCCH.
      - The reference point for the PSSCH-RSRP shall be the antenna connector of the UE.
      - If receiver diversity is in use by the UE, the reported value shall not be lower than the corresponding PSSCH-RSRP of any of the individual diversity branches.
  - The threshold is a (pre)configurable function of the priority information.
    - SA contains the 3-bit PPPP field.
    - The threshold is in a range between [-128 dBm] and [0 dBm] with the granularity of [2] dB including minus infinity and plus infinity.
      - Email discussion until 2nd Sept. on the numbers in the brackets – Philippe (Huawei)
    - The threshold is dependent of both the priority information of the TB to be transmitted and the priority information of the decoded SA.
      - 64 thresholds are (pre)configured in total.
  - In Step 2, a UE that decodes an SA in TTI m + c within the sensing period assumes that the same frequency resource is reserved by the SA transmitter UE at TTI m + d +P*i.
    - P is a parameter fixed to 100 in Rel-14. Possible configurability of this parameter in future releases should be considered in the CR.
    - i is selected in the range [0, 1, …, 10] which will be restricted by carrier-specific network configuration or preconfiguration. i=0 means "no intention to reserve the frequency resource."
      - RAN1 assumes the full flexibility in signaling this restriction, e.g., 10-bit bitmap is signaled in this (pre)configuration to indicate each of [1, …, 10] is allowed or not.
      - Selection of i is up to UE implementation. RAN1 assumes that UE performs no transmission or no resource reservation if it has no data. FFS in RAN2 how to ensure this RAN1 assumption.
    - i is signalled in the SA using a 4-bit field.
  - In Step 2, if an instance of a candidate semi-persistent resource X with the period of P*I collides with a next instance of the resource Y, which is reserved by another UE's SA and meets the condition of exclusion in the agreed threshold-test, then the UE shall exclude resource X.
    - I is the value to be signaled for i in its SA.
  - If the number of remaining resource after Step 2 is smaller than [20]% of the total resources within the selection window, the UE repeats Step 2 using all the thresholds increased by [3] dB until the number of remaining resource after Step 2 is larger than [20]% of the total resources.
    - Each resource in this counting corresponds to the desired resource allocation.
    - Other mechanisms related to the congestion control will be discussed in the V2X WI if time is not allowed in the V2V WI.
    - Companies are encouraged to check what the proper number above is. The number can be revisited during the CR phase.
- In Step 3,
  - The measurement periodicity of PSSCH resource is P in this step.
    - The measurement is restricted to the resources remaining after Step 2.

Consideration of the following are moved to the V2X work item:

- Case of SA and its associated data being transmitted in different subframes

Agreement:

- "The total resources within the selection window" above means the total resources in the interval determined in Step 1 to identify the resources the UE must take into account as possible candidates resources.

Agreement:

- In Step 3,
  - Step 3-0: When the counter reaches zero,
    - With probability p, the UE keeps the current resource and the counter is reset.
    - With probability 1-p, resource is reselected by Step 3-1 and 3-2.
    - Carrier-specific parameter p is (pre)configured in the range [0, 0.2, 0.4, 0.6, 0.8].
  - Step 3-1: UE measures and ranks the remaining PSSCH resources based on total received energy and selects a subset
    - The subset is the set of candidate resources with the lowest total received energy. The size of the subset is [20]% of the total resources within the selection window.
      - Note that the size of this subset is equal to the minimum possible size of the outcome of Step 2.

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- Step 3-2: UE randomly selects one resource from the subset
- When a TB is transmitted in one subframe, when a UE tries to select M sub-channels in one subframe in Step 3, a resource can be any M contiguous sub-channels not excluded in Step 2.
- Energy measurement of each resource is the average of the energy measured in each constituent sub-channel.

Email discussion until 2nd September on the definition of the energy measurement in each sub-channel - Hanbyul (LGE).

[20%] value to be checked until RAN1#86bis.

Agreement:
- When a TB is transmitted in two subframes, at least the following resource selection is supported:
  - One resource is selected using the mechanism defined for the case where a TB is transmitted in one subframe.
  - Selection of another resource is random under the condition that
    - The selected resource shall be in the remaining subset of the outcome of step 3, and
    - The selected resource shall not be in the same subframe as the first resource, and
    - The SCI shall be able to indicate the time gap between the two selected resources.
  - If no resource can meet the condition for the second resource selection, a TB is transmitted only using the first resource.

Any other resource selection methods can be considered in the V2X work item, taking into account progress in ETSI, e.g. the following:
-The resource allocation follows the resource allocation when a TB is transmitted in a single subframe, but the resource is defined as a set of subchannels in two consecutive subframes.

SA resource selection

R1-166826 Resource selection details for UE autonomous resource selection mode in PC5-based V2V LG Electronics
Section 2.2

R1-167834 V2V SA Resource selection PANASONIC R&D Center Germany

R1-167923 WF on SA and data association Huawei, HiSilicon, LGE, Ericsson, Qualcomm
Also supported by Panasonic

Agreement:
- A UE cannot transmit TB without SA, i.e., SA is transmitted with each (re)transmission of a TB.

Agreement:
- At least when a pool is (pre)configured such that a UE always transmits SA and data in the same subframe, UE is not expected to combine PSCCH transmitted in different subframes.

Agreement:
- When a pool is (pre)configured such that a UE always transmits SA and data in adjacent RBs in the same subframe,
  - The sub-channel with the lowest index among those selected for data transmission is used for SA transmission.
- When a pool is (pre)configured such that a UE can transmit SA and data in non-adjacent RBs in the same subframe,
  - The number of SA candidate resources in a SA pool is the same as the number of sub-channels in the associated data pool.
    - Sequential one-to-one association is made between an SA candidate resource and a sub-channel in the associated data pool.
  - The SA resource associated with the lowest index among those selected for data transmission is used for SA transmission.
- PSCCH DM RS CS is blindly detected.
  - Transmitter UE randomly selects one CS out of 4 candidates (details FFS) for every PSCCH transmission.
  - At each SA resource candidate, a UE is not required to decode more than one PSCCH.
    - It is RAN1 understanding that a UE will select the CS with the highest reception power. The related UE requirement is up to RAN4 decision.
- At least when SA and data are transmitted in the same subframe, SA resource should be reselected only when the associated data resource is reselected.

R1-168264 WF on resource selection for SA CATT

Retransmission resource selection

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R1-166826 Resource selection details for UE autonomous resource selection mode in PC5-based V2V LG Electronics
Section 2.1
R1-166714 Details on sensing based resource (re)selection Samsung
Section 2

Option 3-1 vs. option 3-2
R1-166257 Details of sensing using autonomous resource selection for V2V Qualcomm Incorporated
R1-167355 Further details of UE autonomous resource (re)selection for V2V NTT DOCOMO, Inc.
R1-167009 Resource reselection Ericsson

7.2.2.2.2 Details of timing of PSCCH/PSSCH transmission and the indication of the intention to reuse the frequency resource for another TB

Including the discussion points identified in [85-09]

R1-166165 Details of sensing timeline design Huawei, HiSilicon
R1-166258 Details of semi-persistent transmission for V2V Qualcomm Incorporated
R1-166435 Discussion on details of resource reselection and reservation CATT
R1-166513 On timing relationship between sensing window, packet arrival, resource reselection trigger, PSCCH and PSSCH transmissions Intel Corporation
R1-166643 Contents of Schedule Assignment for SPS NEC
R1-166715 Timeline of PSCCH/PSSCH transmission and resource reservation Samsung
R1-166827 Remaining details of the indication of resource reservation LG Electronics
R1-166978 Considerations for UE SPS resource selection and indication ZTE
R1-166992 Discussion on Resource sensing and selection for Mode-2 V2V communications Spreadtrum Communications
R1-167020 Scheduling over PC5 Ericsson
R1-167077 Discussion on the remaining issues of transmission UE behaviour Sony
R1-167356 Further details of sensing based semi-persistent resource selection for V2V NTT DOCOMO, Inc.
R1-167588 Forward reservation of resources on PSCCH INTERDIGITAL COMMUNICATIONS
R1-167738 Scheduling over PC5 Ericsson
R1-167751 Details on PSCCH/PSSCH transmission timing in UE autonomous resource selection mode Innovative Technology Lab Co.

R1-168139 WF on the timeline of sensing and PHY channel transmissions LG Electronics

Agreement:

- UE makes resource selection/reselection decision at TTI m (>=n).
  - TTI m when the UE makes resource selection/reselection decision is the arrival time of the corresponding TB.
- For resource reselection, the UE must take into account as possible candidates resources in the interval [m+T1,m+T2] in Step 1.
  - T1 <= [4] where T1 is up to UE implementation.
  - 20 <= T2 <=100 where T2 is up to UE implementation.
    - Selection of T2 shall fulfill the latency requirement.
- Sensing window is changed to [m-a, m-b), where a=b+1000 and b=1.
- Note: If there is any inconsistency between the above proposal and the existing agreement, the above proposal overrides.
- If a problem is found, e.g., in designing the time resource indication in SCI, this agreement may be revisited.

7.2.2.2.3 Details of the measurement metric to reflect the congestion level

R1-166955 Congestion Control Framework for V2V Ericsson
R1-166259 Measurement metric for congestion control Qualcomm Incorporated

R1-166166 Congestion control for V2V Huawei, HiSilicon
R1-166431 Measurement metric for the congestion level in V2X CATT
R1-166514 Metric and sidelink measurements for V2V congestion control Intel Corporation
R1-166616 UE measurement based congestion control Guangdong OPPO Mobile Telecom.
R1-166716 Discussion on congestion control Samsung
R1-166828 Details of congestion level measurement LG Electronics
R1-166953 Radio measurements for congestion control for V2X Ericsson
R1-166969 Discussion on channel busy ratio measurement in V2V Panasonic
R1-166979 Discussion on congestion control of PC5 carrier ZTE

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R1-167410 Considering measurement metric and report for zone based resource management in V2V service ITRI
R1-167422 Adaptation of MCS, RB allocation, and number of retransmissions Ericsson
R1-167621 Discussion on details of UE measurement for resource reselection Potevio
R1-167745 Congestion management for V2V in 5.9GHz ITS VODAFONE Group Plc
R1-167802 On congestion control for V2V communication Nokia, Alcatel-Lucent Shanghai Bell

R1-168348 WF on CBR measurement – Ericsson
For email discussion until 2nd September (Stefano, Ericsson)

R1-168080 WF on V2V congestion control - Ericsson
For email discussion until 2nd September (Stefano, Ericsson)

7.2.2.2.4 Others

R1-166644 On the needs of collision detection and resolution in V2X NEC

7.2.2.3 Remaining details of resource pool design

Including how to configure SA and data resources and how a data pool is associated with an SA pool

R1-166162 Multiplexing of SA and its associated data Huawei, HiSilicon
R1-166161 Resource pool design Huawei, HiSilicon
R1-166163 Indication of time and frequency resources Huawei, HiSilicon
R1-166260 Details of Resource Pool Design Qualcomm Incorporated
R1-166436 Resource pool enhancement in PC5-based V2V CATT
R1-166515 Details of resource pool design for sidelink V2V communication Intel Corporation
R1-166576 Consideration on V2V sub-channelisation Beijing Xinwei Telecom Techn.
R1-166645 Resource pool design for V2X NEC
R1-166717 Details on resource pool design Samsung
R1-166829 Remaining issues for resource pool configuration LG Electronics
R1-166963 On the orthogonality of SA and data pools Ericsson
R1-166974 Pool design for V2V Ericsson
R1-166975 On Pools Overlap for Mode 1 and Mode 2 Ericsson
R1-166980 Discussion on resource pools for V2V ZTE
R1-167357 Discussion on resource pool for PC5 based V2V Communications NTT DOCOMO, Inc.
R1-167619 V2V resource pool allocation Potevio
R1-167695 On PSCCH and PSSCH retransmission and combining options Intel Corporation

R1-168101 WF on resource pool configuration LG Electronics

Agreement:

- Case 1: When a pool is (pre)configured such that a UE always transmits SA and data in adjacent RBs in the same subframe,
  - The resource pool consists of one or multiple sub-channels in frequency domain.
    - A sub-channel consists of a group of contiguous RBs in a same subframe.
    - The sub-channel size in a resource pool can be configured by eNB or preconfigured.
      - Candidate size of a sub-channel is {5, 6, 10, 15, 20, 25, 50, 75, 100}
    - Each sub-channel includes one SA resource candidate at the low end of the sub-channel from system perspective.
      - The SA resource candidate can be used for data transmissions.
    - Resource pool configuration includes the number of sub-channels in the pool.
    - Different sub-channels have disjoint group of adjacent RBs.
- Case 2: When a pool is (pre)configured such that a UE transmits SA and data potentially in non-adjacent RBs in the same subframe,
  - The PSSCH resource pool consists of one or multiple sub-channels in frequency domain.
    - A sub-channel consists of a group of contiguous RBs in a same subframe.
    - The sub-channel size in a resource pool can be configured by eNB or preconfigured.
      - Candidate size is for email discussion until 2nd September (Hanbyul, LGE).
        - Note that only the RB sizes supported for UE transmission in Rel-13 will be supported in Rel-14 V2V.
        - The maximum number of sub-channels possible in a subframe is 20.
        - The minimum candidate size is not less than 4.
    - PSSCH resource pool configuration includes the number of sub-channels in the pool.
    - Different sub-channels have disjoint group of adjacent RBs.
    - A resource pool consists of N contiguous PRBs in frequency domain.
      - N = The sub-channel size * the number of sub-channels.

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- The PSCCH resource pool consists of a set of contiguous PRBs.
  - The size of a PSCCH resource pool is configurable.
  - Candidates of PSCCH resource are disjoint.
- Energy sensing granularity of PSSCH in Step 3 is the size of sub-channel.
- The UE always (re)selects an integer number of adjacent subchannels for transmission.
- A UE is not expected to try to decode more than [100] RBs in a subframe.
- A UE is not expected to try to decode more than [10] PSCCHs in a subframe.
- SA pool and the associated data pool can overlap. An SA pool and a non- associated data pool can overlap.
  - This overrides the existing agreement including "An RB of an SA pool in a TTI cannot be included an un-associated data pool (if exists)" made in RAN1#84bis.

Agreement:
- When a pool is (pre)configured such that a UE always transmits SA and data in adjacent RBs in the same subframe,
  - A resource pool consists of N contiguous PRBs in frequency domain.
    - N = The sub-channel size * the number of sub-channels.
    - A UE transmits PSSCH on the largest subset of PRBs in the selected sub-channel(s) subject to the DFT size restriction and the adjacency to the associated SA resource.
- When a pool is (pre)configured such that a UE can transmit SA and data in non-adjacent RBs in the same subframe,
  - The UE always transmits on an integer number of adjacent subchannels.

R1-168082 WF on pools for V2X Ericsson

Agreement:
- V2V pool is defined by a repeating bitmap mapped to all subframes except for at least SLSS subframes which are skipped
  - The bitmap length is 16, 20, or 100.
  - FFS if/how to handle the case where the bitmap does not repeat an integer number of times within the DFN period
- The bitmap defines which subframes are allowed for V2V SA/data transmission and/or reception for a pool.

Association of SA and data

R1-166162 Multiplexing of SA and its associated data Huawei, HiSilicon

R1-167925 WF on time resources indication Huawei, HiSilicon, LGE, Ericsson

Agreement:
- Once resource reselection is triggered, UE reselects resources for all the transmissions corresponding to a TB.
- SA only schedules transmission(s) corresponding to one TB.
- UE is not required to perform PSSCH-RSRP measurement in a TTI that occurs before the reception of a successfully decoded associated SA.
  - UE applies the PSSCH-RSRP measured in a TTI that occurs at or after the reception of a successfully decoded associated SA to a TTI that is indicated by the SA but occurs before the reception of the SA.
- Number of transmissions of a TB is 1 or 2.
- Each SA indicates the time/frequency resources of all the data transmissions corresponding to the same TB.

7.2.2.4 Remaining details of scheduling for sidelink resource in eNB scheduling mode

R1-166956 Cross carrier and multi-operator scheduling for V2V over PC5 Ericsson

7.2.2.4.1 Details of DCI format for SPS and dynamic scheduling

Including how to trigger/release different SPS configurations

R1-167091 Details of DCI in eNB scheduling mode CMCC
R1-167358 (E)PDCCH for sidelink SPS configuration switching NTT DOCOMO, Inc.
R1-167839 Details on PC5 SPS enhancement PANASONIC R&D Center Germany

R1-166126 Enhancements to support cross-carrier scheduling for V2V Huawei, HiSilicon
R1-166167 SPS enhancement for V2V Huawei, HiSilicon
R1-166203 DCI design for V2V Huawei, HiSilicon
R1-166261 Details of DCI and SPS configuration Qualcomm Incorporated

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R1-166430 Discussion on eNB signaling in V2V mode 1 CATT
R1-166718 Sidelink SPS operation for eNB scheduling mode Samsung
R1-166830 Remaining details of (E)PDCCH design of scheduling for sidelink resource LG Electronics
R1-166957 Contents of Downlink Control Information for V2V over PC5 Ericsson
R1-166970 Discussion on DCI design in V2V Panasonic
R1-166981 Scheduling of V2V SPS resources ZTE
R1-167589 DCI contents for SPS and resource allocation in Mode 1 INTERDIGITAL COMMUNICATIONS

WF on multiple SPS configuration Huawei
WF on eNB scheduling DOCOMO

Agreement:

- DCI for dynamic scheduling:
- At least the following fields are included in the DCI
  - CIF (3 bits)
    - Interpretation of CIF is (pre)configured. This (pre)configuration can be different from CIF for UL/DL.
  - Lowest index of the sub-channel allocated to the initial transmission
  - SA content
    - Time gap between initial transmission and retransmission: [4] bits
    - Frequency resource location of the initial transmission and retransmission: 8 bits
  - FFS
    - TPC
- The DCI length is the same as DCI format 0 configured for UL of the UE.
  - An RNTI different from C-RNTI/SPS-RNTI is used.
- Time location of the initial transmission is the first subframe included in the resource pool on the V2V carrier that occurs after 4 ms from the DCI transmission subframe.
- Email discussion until 2nd September to finalise the above square-bracketed figure and FFS (Shailesh, Qualcomm)

SPS scheduling is postponed to V2X work item, e.g.:

- For SPS, the following are included in the DCI in addition to the content of the DCI for dynamic scheduling:
  - SPS configuration indicator
    - FFS whether this can indicate more than 1 SPS configuration
  - SPS activation / release indicator

7.2.2.4.2 Others

7.2.2.5 Remaining details of SCI contents

R1-166202 Scheduling assignment design for V2V Huawei, HiSilicon
R1-166262 Details of SCI Qualcomm Incorporated
R1-166434 Discussion on contents of scheduling assignment CATT
R1-166516 Scheduling assignment for sidelink V2V communication Intel Corporation
R1-166719 SCI size and SCI contents Samsung
R1-166831 Remaining issues on SCI contents LG Electronics
R1-166971 Repetition and relationship between SA and associated data Panasonic
R1-166982 Discussion on SA content ZTE
R1-167011 Contents of PSCCH for V2V over PC5 Ericsson
R1-167359 Discussion on enahancement of scheduling assignement in V2V communications NTT DOCOMO, Inc.
R1-167510 SA contents for V2V Lenovo (Beijing) Ltd
R1-167590 SCI contents for R14 V2V INTERDIGITAL COMMUNICATIONS

Agreement:

- SCI contents (48 bits in total):
  - Priority: 3 bits
  - Resource reservation: 4 bits
  - MCS: 5 bits
  - CRC: 16 bits
- Retransmission index: 1 bit
- Time gap between initial transmission and retransmission: [4] bits
  - This fields indicates a value in [0, [15]]. Value 0 means no retransmission of the associated TB.
  - Frequency resource location of the initial transmission and retransmission: Working assumption: 8 bits
  - Frequency location of the other transmission and the number subchannels are jointly encoded.
  - Reserved bits: [7] bits

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- A UE transmitting SCI defined in Rel-14 V2V WI shall set all these bits to 0.
- A UE shall not use this field as virtual CRC.
- RV 0 and 2 are used for the initial transmission and retransmissions, respectively.

Email discussion until 2nd September to confirm the above working assumption and square-bracketed figures, and the details of joint encoding of frequency location of the other transmission and number of subchannels (Philippe, Huawei)

7.2.2.6 Remaining details of coexistence of PC5-based V2V operation and legacy Uu operation

Including prioritizing sidelink transmissions over UL transmissions

R1-166125 Coexistence of cellular and V2V services on the same carrier Huawei, HiSilicon
R1-166206 Power control for SA and data Huawei, HiSilicon
R1-166263 Coexistence of PC5 and Uu for V2V Qualcomm Incorporated
R1-166720 Coexistence of Uu and PC5 based V2V Samsung
R1-166832 Remaining issues on coexistence of PC5-based V2V and legacy Uu LG Electronics
R1-166961 On the Need for V2V Gaps Ericsson
R1-166983 Co-existence of PC5-based V2V operation and legancy Uu operation ZTE
R1-167175 Coexistence of cellular and V2V services in partial network coverage Huawei, HiSilicon
R1-167360 Details of prioritizing sidelink transmissions over UL transmissions NTT DOCOMO, Inc.
R1-167591 Coexistence of PC5-based V2V and legacy Uu operation INTERDIGITAL COMMUNICATIONS
R1-167803 On Prioritization of V2V Sidelink TX over WAN UL TX Nokia, Alcatel-Lucent Shanghai Bell

Power control
R1-166206 Power control for SA and data Huawei, HiSilicon

R1-168146 WF on power control LG Electronics, Huawei, HiSilicon, Qualcomm

Agreement:

- When PSCCH and the associated PSSCH are transmitted in the same subframe,
  - Power control parameters are (pre)configured only for PSSCH.
  - PSD offset to that of PSSCH is used to determine the transmission power of PSCCH.
    - The PSD offset is fixed to X(FFS in [0, 3]) dB in specifications.
    - Email approval until 1st September – Hanbyul (LGE)
  - For all cases, the PSD difference between PSCCH and PSSCH shall be the same as the PSD offset value.

7.2.2.7 Remaining details of sidelink synchronization procedure

Including priority order of synchronization sources for remaining cases. Low priority is given to enhancements to Rel-12/13 SLSS-based synchronization.

R1-166168 Timing alignment of different synchronization sources for V2V Huawei, HiSilicon
R1-166200 OOC sync priority and SLSS ID set definition Huawei, HiSilicon
R1-166201 PSBCH contents and SLSS transmission procedure Huawei, HiSilicon
R1-166207 Sidelink synchronization enhancement in V2V communication Huawei, HiSilicon
R1-166264 Synchronization Procedure for V2V Qualcomm Incorporated
R1-166432 Synchronization enhancements in PC5-based V2V CATT
R1-166433 Timing alignment for V2V CATT
R1-166517 Sidelink synchronization procedure for V2V communication Intel Corporation
R1-166617 Discussion on the GNSS based synchronization Guangdong OPPO Mobile Telecom.
R1-166618 Discussion on the V2V synchronization source priority Guangdong OPPO Mobile Telecom.
R1-166721 Remaining issues on sidelink synchronization Samsung
R1-166833 Remaining details of sidelink synchronization LG Electronics
R1-166960 Distributed Synchronization Procedure for V2X over PC5 Ericsson
R1-166964 Receiver Timing Assumptions for V2V SL Operation Ericsson
R1-166984 The remaining details of sidelink synchronization procedure ZTE
R1-167007 PSBCH Contents for V2V Ericsson
R1-167012 V2V Signals Transmission Dropping for SLSS Reception Ericsson
R1-167014 SLSS/PSBCH and Transmitter Behavior under Congestion Control Restrictions Ericsson
R1-167361 SLSS enhancements for GNSS based synchronization NTT DOCOMO, Inc.
R1-167411 Discussion priority order and multiple synchronization references on sidelink synchronization procedure for V2V communication ITRI
R1-167412 Coordination among multiple synchronization sources on sidelink synchronization procedure for V2V communications ITRI
R1-167592 Priority order of synchronization sources INTERDIGITAL COMMUNICATIONS
R1-167608 Further Discussions on V2V Synchronization Design SHARP Corporation, MTI

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R1-167804 Final details of V2V synchronization procedure Nokia, Alcatel-Lucent Shanghai Bell
R1-167837 V2V synchronization remaining issues PANASONIC R&D Center Germany

R1-168283 WF on GNSS Priority for Synchronization Huawei, HiSilicon

Agreement:

- GNSS is at the highest priority of synchronization source for time and frequency when the following conditions are met:
  - The UE is out of coverage on the V2X carrier (as defined by RAN2)
  - The UE does not receive any eNB synchronization configuration
  - The UE directly receives GNSS with sufficient reliability (as defined by RAN4)
  - The UE does not receive any SLSS_net signal with in-coverage indicator 1
- The existing agreements apply when at least one of the above conditions is not met.
  - FFS UE behaviour when the UE is out-of-coverage and receives SLSS_net.
- RAN1 observed the potential benefit of (pre)configuring an offset to shift the DFN #0 w.r.t the reference timing derived from GNSS. RAN1 assumes that RAN2 will decide whether this feature will be included in the outcome of V2V WI.
  - The offset is in range [0, 1 ms] with the granularity of 1 us.
- LS to RAN2 to inform this (Stefano – Ericsson) in R1-168244. Approved in R1-168250 with adding RAN4 to CC.

Agreement:

- SLSS period is 160 ms. Note that this changes the existing working assumption.

7.2.2.8 Others

R1-166834 Open issues for V2V work item completion LG Electronics
R1-166835 on supporting 64 QAM for PC5-based V2V LG Electronics
R1-167152 Discussion on inband emission suppression for V2V communications Huawei, HiSilicon

Rapporteur will capture in the status report all remaining essential issues of V2V that are to be transferred to the V2X WI.

LS to RAN2:
R1-168202

7.2.3 LTE-based V2X Services

WID in RP-161298

R1-168404 Chairman's Notes of Agenda Item 7.2.3 on LTE-based V2X Services Session Chairman (Nokia)
Contents incorporated below
Endorsed

R1-166836 Work plan for LTE-based V2X Services LG Electronics

7.2.3.1 Enhancement to UL SPS

Including support for multiple SPS configurations

R1-166170 SPS enhancement on Uu for V2X Huawei, HiSilicon
R1-166265 Uplink SPS enhancements for V2X Qualcomm Incorporated
R1-166437 Discussion on enhancement of UL SPS in V2X CATT
R1-167015 UL-SPS for LTE-based V2X services Ericsson

Agreements:

- A SPS RNTI for V2X over Uu is necessary.
  - FFS whether this SPS RNTI is specific to V2X or can be the same as the legacy SPS C-RNTI
- A DCI format 0 for V2X scrambled by the SPS RNTI for V2X is used to activate or update the SPS.
- Both explicit release and an implicit release mechanism for SPS over Uu are supported (details FFS).
- Explicit signaling from the UE to the eNB (ask RAN2 if they can design the appropriate signalling, e.g. using a MAC CE) can be used to indicate to the eNB when activation/update/release is desired.
  - For activation, a "desirable time offset" (e.g. relative to SFN0) is included
- When the period is to be changed, the UE notifies the eNB with the new period
- Multiple SPS configurations can be active at the same time.

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- An indicator(s) in DCI format 0 (e.g. SPS index or an indicator mapped to SPS index) is used to differentiate SPS configurations.
  - FFS whether existing field(s) (e.g. TPC for PUSCH) is reused or a new field is added
- FFS whether each SPS configuration is always activated/released by a separate DCI or whether multiple SPS configurations can be activated or released by a single DCI.

- In the event of a resource conflict between SPS configurations, only one transmission can occur
  - RAN1 leaves it up to RAN2 to determine any possible mechanism for resolving resource conflicts between SPS configurations

R1-166837	Discussion on details of (E)PDCCH design for uplink SPS	LG Electronics

7.2.3.2 Resource selection for pedestrian UEs

Including random resource selection for P-UEs potentially on the PC5 resource pool shared with V-UE transmissions, with additional study on sensing operation during a limited time for P-UEs

R1-166838	Discussion on P-UE sidelink transmissions	LG Electronics
R1-166266	PC5 for V2P	Qualcomm Incorporated
R1-167805	On resource selection for V2P communication	Nokia, Alcatel-Lucent Shanghai Bell
R1-166723	Resource selection for pedestrian UE	Samsung
R1-166205	Discussion on the P-UE resource selection	Huawei, HiSilicon
R1-166986	Considerations for resource selection for P-UEs	ZTE
R1-166965	Discussion on P2x	Ericsson
R1-167362	Evaluation and discussion on resource selection for pedestrian UEs	NTT DOCOMO, Inc.
R1-167869	Discussion on sensing operation for P-UE	Sequans Communications
R1-166438	Discussion on resource selection for P-UE	CATT
R1-166993	Discussion on resource sensing and selection for pedestrian UEs	Spreadtrum Communications
R1-167512	Discussion on resource selection for pedestrian UEs	Lenovo (Beijing) Ltd
R1-167609	Power Efficient Sensing for V2X Pedestrian UEs	SHARP Corporation
R1-168385	WF on pedestrian UE resource selection	NTT Docomo, Huawei, HiSilicon

Proposal:

- If shared Tx resource pool is used by pedestrian UEs and vehicle UEs
  - Pedestrian UE can sense in a subset of subframes and skip sensing in other subframes for energy saving
    - FFS details on how/when UE skip sensing
    - Vehicle UE resource selection is reused as the baseline for pedestrian UE resource selection
      - FFS details
  - FFS whether pedestrian UE can skip sensing in all the subframes and use random resource selection

Agreement:

- The specification supports the possibility for a P-UE to use random selection, including at least all P-UEs which do not have sidelink Rx capability
  - If a P-UE uses random selection, it shall only pools in which random selection by P-UEs is permitted
  - It is up to network configuration whether a pool in which random selection by P-UEs is permitted overlaps with other pools
  - The specification supports the possibility to configure pools in which random selection by P-UEs is not permitted
- The specification supports the possibility for a P-UE to use partial sensing in a subset of subframes
  - Details of P-UE partial sensing are FFS
    - V2V sensing-based resource selection is the baseline; strive to define P-UE partial sensing-based resource selection to be as similar as possible to V2V sensing-based resource selection
  - FFS whether support of partial sensing is mandatory for P-UEs with sidelink Rx capability
  - FFS under what conditions a P-UE that supports partial sensing uses partial sensing
  - If a P-UE uses partial sensing,
    - details of resource pool FFS

Pedestrian Authorization

R1-167817	Discussion on Pedestrian Authorization	Ericsson
R1-167828	[DRAFT] LS on Pedestrian Authorization	Ericsson

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7.2.3.3 Others

Including support of inter-PLMN for Uu and PC5

R1-166208 Discussion on inter-PLMN supporting Huawei, HiSilicon
R1-166267 Inter-PLMN support for PC5 and Uu Qualcomm Incorporated
R1-166962 Discussion on inter-PLMN V2x PC5 and Uu operation Ericsson

R1-166209 Design for multi-carrier operation Huawei, HiSilicon

R1-166268 Co-channel coexistence for DSRC and LTE-V2V Qualcomm Incorporated
R1-166839 Considerations on the co-channel coexistence of LTE PC5 V2V and IEEE 802.11p LG Electronics

R1-166985 Uu transport enhancement for V2X ZTE

R1-168025 LS to RAN2, RAN3 and SA2 on RAN1agreements LGE
Approved in R1-168026.

7.2.4 Enhancements on Full-Dimension (FD) MIMO for LTE

WID in RP-160623
R1-168405 Chairman's Notes of Agenda Item 7.2.4 on Enhancements on Full-Dimension (FD) MIMO for LTE
Session Chairman (Samsung, Nokia)
Contents incorporated below
Endorsed with following updates

R1-166724 Rapporteur Workplan on eFD-MIMO Samsung, Nokia, CATT

7.2.4.1 Reference signals

7.2.4.1.1 Non-precoded CSI-RS

At least decide on:
- *Mk value(s)*
- *High level mechanism for CSI-RS overhead reduction*

CSI-RS aggregation details
R1-166725 Discussions on CSI-RS enhancements for Class A CSI reporting Samsung
R1-167955 Further discussion on non-precoded CSI-RS design for eFD-MIMO ZTE Corporation, ZTE Microelectronics
Revision of R1-166329
R1-166269 Non-precoded CSI-RS design for up to 32 ports Qualcomm Incorporated
Section 2
R1-167137 CSI-RS pattern design for up to 32 ports Huawei, HiSilicon
R1-166339 Nonprecoded CSI-RS for Class A CSI Reporting Nokia, Alcatel-Lucent Shanghai Bell
Section 2
R1-166519 Performance comparison of CDM-4 and CDM-8 for CSI-RS Intel Corporation

R1-167980 WF on aggregation for NP CSI-RS ZTE Corporation, ZTE Microelectronics, Qualcomm, Xinwei, Potevio
R1-168056 WF on CDM-2 and CDM-4 for non-precoded CSI-RS LG Electronics, ITRI, Samsung, Ericsson, ZTE
R1-168049 WF on Class A CSI-RS Enhancement CATT, Alcatel-Lucent Shanghai Bell, Intel, InterDigital, Nokia, Huawei, HiSilicon
Also supported by Qualcomm

Agreements:
- For {24, 32} ports, $\sum_k M_k \in \{24, 32\}$, $M_k = 8$, where M_k is the same for all k
- For {20, 28} ports, $\sum_k M_k \in \{20, 28\}$, $M_k = 4$, where, at least for CDM-2, M_k is the same for all k
  - FFS whether $M_k = 8$ is also supported, and if so, whether M_k is the same or different for different k for CDM-4
- FFS port indexing
- In Rel-14, CDM-2 and CDM-4 is supported.
  - For CDM-2, port numbering in Rel-13 is reused in order to share CSI-RS with legacy UEs.

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- FFS CDM-4 port numbering

Working Assumption:

- CDM-8 is supported for at least {24,32} port CSI-RS
  - FFS CSI-RS aggregation and CDM mapping details
  - FFS additional REs other than legacy CSI-RS RE

R1-167996 WF on CDM aggregation for NP CSI-RS Samsung, Xinwei, Ericsson

R1-167346 Discussion on non-precoded CSI-RS design NTT DOCOMO, INC.
Section 2.2
R1-166439 CSI-RS design for {20,24,28,32} ports CATT
R1-166577 Further discussion on non-precoded CSI-RS designs for eFD-MIMO Beijing Xinwei Telecom Techn.
Sections 2,3
R1-166518 Discussion on CSI-RS for Class A FD-MIMO Intel Corporation
R1-166632 Discussion on CSI-RS with CDM8 NEC
R1-166840 Discussions on NP CSI-RS designs for eFD-MIMO LG Electronics
Section 2
R1-167618 CSI-RS design for eFD-MIMO Potevio
Sections 2.1, 2.2
R1-167634 Performance of CDM-8 for Non-Precoded CSI-RS Ericsson

CSI-RS overhead reduction

R1-166726 Discussions on NP CSI-RS overhead reduction Samsung
R1-167633 CSI-RS Design for Class A eFD-MIMO Ericsson
R1-166440 Discussion on CSI-RS overhead reduction for class A CATT
R1-166339 Nonprecoded CSI-RS for Class A CSI Reporting Nokia, Alcatel-Lucent Shanghai Bell
Section 3
R1-167635 Support of CSI-RS port sharing with Rel-13 and Rel-12 UEs Ericsson
R1-167652 On CSI-RS Overhead Reduction Schemes InterDigital Communications

R1-167981 WF on overhead reduction for Class A NZP CSI-RS ZTE Corporation, ZTE Microelectronics, Ericsson, Samsung, NTT DOCOMO

Agreement:

At least for Class A NZP CSI-RS with more than 16 CSI-RS ports:

- All ports in a CSI-RS resource are transmitted within the same subframe
  - i.e. CSI-RS overhead reduction is done in the frequency domain
- CSI-RS density d ∈ {1,1/2, and at least one other value <= 1/3} RE/RB/port
  - Other values of d are not precluded (e.g. $^2/_3$, ¾)
  - FFS whether different ports in a CSI-RS resource may have different densities
- FFS PDSCH rate matching in the REs in PRBs with no CSI-RS ports within a group
  - Opt-1: comb like transmission
  - Opt-2: frequency domain measurement restriction
- FFS the detailed signalling design

R1-167092 Discussion on non-precoded CSI-RS enhancement CMCC
R1-166269 Non-precoded CSI-RS design for up to 32 ports Qualcomm Incorporated
Section 3
R1-166325 Aperiodic CSI-RS for non-precoded CSI-RS ZTE Corporation, ZTE Microelectronics
R1-166577 Further discussion on non-precoded CSI-RS designs for eFD-MIMO Beijing Xinwei Telecom Techn.
R1-166840 Discussions on NP CSI-RS designs for eFD-MIMO LG Electronics
Section 3
R1-167346 Discussion on non-precoded CSI-RS design NTT DOCOMO, INC.
Section 2.1
R1-166633 Proposals for CSI-RS overhead reduction NEC
R1-167618 CSI-RS design for eFD-MIMO Potevio
Section 2.3

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R1-166727 Discussions on CDM-8 for NP CSI-RS Samsung

7.2.4.1.2 Beamformed CSI-RS

At least decide on:

- *Scheme 1 and/or 2 – if down selection is needed*
- *Additional FFS details on scheme 1 and/or 2*

R1-166442 Support for aperiodic CSI-RS CATT
R1-166520 Evaluation of CSI-RS overhead reduction for Class B using frequency decimation Intel Corporation
R1-166728 Additional details on aperiodic CSI-RS Samsung

R1-167653 On Rate-matching of A-CSI-RS InterDigital Communications
R1-167675 Aperiodic CSI-RS transmission for beamformed CSI-RS Huawei, HiSilicon

R1-168046 WF on Aperiodic CSI-RS for Rel.14 Samsung, Nokia, Alcatel-Lucent Shanghai Bell, KT Corporation, Ericsson, LG Electronics, Interdigital, Qualcomm, AT&T, CHTTL, Xinwei, Straightpath, ITL

Agreement:
Aperiodic CSI-RS

- Two-step NZP CSI-RS resource configuration:
  - Step 1. RRC configuration with a newly defined Aperiodic CSI-RS-Resource-Config IE
    - Without Subframe_config
    - Configure a UE with ***K*** = {1, 2, .., 8} CSI-RS resources
  - Step 2. Activation/release mechanism
    - Activate ***N*** out of ***K*** CSI-RS resources per CSI process
      - Note: Activation refers to down selection of N out of K CSI-RS resources
      - Once activated, a CSI resource remains activated until released
      - FFS: Whether N is always equal to K or the case where K=N is not precluded
        - » If N is always equal to K, step 2 is bypassed
    - Choose at least one of the following alternatives for activation/release mechanism (TBD in RAN1#86bis)
      - Alt1. Using UL grant(s)
        - » FFS: Support for cross-carrier activation/release
      - Alt2. Using MAC CE
      - Other alternatives are not precluded
      - FFS the values of X and Y, max value of ***N*** (or the value of *N*), how to signal *N*
- One out of ***N*** CSI-RS resources is selected via the UL-related DCI
  - A UL grant carries a CSI request and indicates transmission of one CSI-RS resource if ***N***>1 aperiodic CSI-RS resources are activated for a CSI process for which the CSI is requested
    - A CSI request is for one CSI-RS resource per CSI process
    - Choose one out of the following alternatives for indicating transmission of **1** out ***N*** CSI-RS resources (TBD in RAN1#86bis)
      - Alt1. use code points from an existing DCI field to select **1** out ***N*** CSI-RS resources
      - Alt2. Introduce additional bit(s) in DCI
      - Note: The number DCI fields and number of code points for the combinations of CSI process, CC, and CSI-RS resource indication are FFS
- Only PUSCH based A-CSI reporting is supported
- Aperiodic CSI-RS transmission is in the same DL subframe as the associated UL-related DCI
  - FFS: Whether to CSI reference resource definition needs to change when aperiodic CSI-RS is used or not
- Whether and, if needed, how to support CSI processing relaxation for aperiodic CSI-RS are TBD
- FFS: Possibility to support aperiodic CSI-RS with *K*=1 and trigger (using UL-related DCI carrying A-CSI request) a subset of antenna ports.

"Multi-shot" CSI-RS

- Two-step NZP CSI-RS resource configuration:
  - Step 1. RRC configuration with a *Rel-13 periodic* CSI-RS-Resource-Config IE
    - Configure a UE with ***K*** = {1, 2, .., 8} CSI-RS resources
  - Step 2. Activation/release mechanism
    - Activate ***N*** out of ***K*** CSI-RS resources per CSI process

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        - Note: Activation refers to transmission of N CSI-RS resources
        - Once activated, a CSI resource remains activated until released
    - Choose at least one of the following alternatives for activation/release mechanism (TBD in RAN1#86bis)
        - Alt1. Using UL grant(s)
            - » FFS: Support for cross-carrier activation/release
        - Alt2. Using MAC CE
        - Other alternatives are not precluded
        - FFS the values of X and Y, max value of ***N*** (or the value of N), how to signal *N*
- CSI reporting
    - *N*=1: CQI/PMI/RI is reported
    - *N*>1: CRI (=0,1, …, *N* – 1) is reported along with CQI/PMI/RI associated with the reported CRI value

Overhead reduction for Class B – both for periodic and aperiodic CSI-RS
- Support CSI-RS frequency-domain density reduction for Class B
    - All antenna ports of a single CSI-RS resource configuration can be transmitted every N PRBs
        - *N* = 1 (existing CSI-RS design), 2, and >2
        - FFS: Exact mechanism

R1-168147 WF on Rate Matching Issue for Beamformed CSIRS LG Electronics, InterDigital, Samsung, Huawei, HiSilcon, Qualcomm, CATT

Agreement:
- A solution is to be selected from the following three alternatives for aperiodic ZP CSIRS resource indication (TBD RAN1#86bis)
    - Alternative-1: Aperiodic ZP CSIRS, dynamically indicated by a new common DCI.
        - The common DCI is monitored in common search space.
    - Alternative-2: Aperiodic ZP CSIRS, aperiodic ZP CSI-RS resource signaling field is introduced in DL DCIs for all TMs.
    - Alternative-3: Use the existing PQI states or increase the number of PQI states for TM10; no PDSCH RM solution for other TMs
        - In this case, aperiodic ZP CSIRS resource is not defined
- Definition of Aperiodic ZP CSIRS:
    - For PDSCH rate matching on BF CSIRS due to aperiodic CSI-RS and/or multi-shot CSI-RS, an aperiodic ZP CSIRS resource is indicated.
        - Aperiodic ZP CSIRS resource configuration is defined without Subframe_config
        - UE conducts PDSCH rate matching on aperiodic ZP CSIRS at the subframe when the DCI is signaled.
- Study the impact of collision between EPDCCH RE and aperiodic CSI-RS

R1-168148 WF on QCL issue for Beamformed CSIRS LG Electronics, Samsung, Intel

Agreement:
- Decide the need for QCL indication on DMRS to aperiodic and/or multi-shot CSI-RS NZP CSIRS (TBD RAN1#86bis)
- If needed, at least one solution is to be selected from the following alternatives (TBD RAN1#86bis)
    - Alt 1: UE is not expected that aperiodic and/or multi-shot NZP CSIRS is indicated in PQI for QCL purpose with DMRS.
    - Alt 2: aperiodic and/or multi-shot NZP CSIRS can be indicated in PQI for QCL purpose, and follow legacy QCL assumption
        - Periodic NZP CSI-RS can also be indicated for QCL purpose

R1-166270 Enhancements on Beamformed CSI-RS Qualcomm Incorporated
R1-166324 Enhancements on Beamformed CSI-RS ZTE Corporation, ZTE Microelectronics
R1-166340 Aperiodic CSI-RS and Overhead Reduction Nokia, Alcatel-Lucent Shanghai Bell
R1-166441 Discussion on CSI-RS overhead reduction for class B CATT
R1-166578 Further discussion on beamformed CSI-RS designs for eFD-MIMO Beijing Xinwei Telecom Techn.
R1-166841 Remaining details on beamformed CSI-RS enhancements LG Electronics
R1-167138 Rate matching enhancements for aperiodic CSI-RS in different transmission mode Huawei, HiSilicon
R1-167347 Discussion on Aperiodic CSI-RS NTT DOCOMO, INC.
R1-167636 Beamformed CSI-RS Design with Activation Mechanism Ericsson

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R1-167637 UE specific Beamforming with Aperiodic CSI-RS Transmission Ericsson
R1-167651 Remaining Issues on A-CSI-RS InterDigital Communications

7.2.4.1.3 Uplink DM-RS

At least decide on:

- *Choosing one from IFDMA and DMRS sequence enhancements*
- *Additional details on the chosen scheme*

R1-166521 Remaining details of UL DMRS enhancement Intel Corporation
R1-166271 Discussion on uplink DMRS enhancements for FD-MIMO Qualcomm Incorporated
R1-166141 Uplink DMRS enhancement to support more orthogonal partial overlapped ports Huawei, HiSilicon

R1-166341 Control Signalling for UL DMRS with IFDMA Nokia, Alcatel-Lucent Shanghai Bell
R1-166326 Discussion on UL DMRS enhancement for eFD-MIMO ZTE Corporation, ZTE Microelectronics
R1-166742 Proposals on uplink DMRS design enhancements Samsung

R1-167087 UL DMRS Base Sequences with IFDMA Nokia, Alcatel-Lucent Shanghai Bell
R1-167139 Uplink DMRS sequence enhancement for IFDMA Huawei, HiSilicon

R1-166634 Discussion on IFDMA based scheme NEC
R1-166842 Discussion on uplink DMRS enhancements for eFD-MIMO LG Electronics
R1-166443 On UL DMRS enhancement CATT

R1-168050 WF on UL DMRS enhancement Intel

R1-167972 WF on UL DMRS Nokia, Alcatel-Lucent Shanghai Bell, Huawei, HiSilicon

Agreement:

- Support orthogonal DMRS (more than 2) for MU-MIMO with partial overlapping BW allocation by
  - IFDMA with at least RPF 2
    - FFS: RPF 4
- FFS during this week which new IFDMA sequence lengths (if any) shall be supported and designed
  - If any new lengths larger than 36 are supported, the corresponding DMRS sequences are generated by the legacy mechanism by extension of a Zadoff-Chu sequence
- FFS: whether and how CS of DMRS generation shall be modified to improve backward compatibility for the pairing with legacy UE.
- Additional power boosting shall be supported and applied to IFDMA DMRS depending on the value of RPF
  - FFS: x dB for RPF 2 and y dB for RPF 4

R1-168368 WF on UL DMRS Lengths Nokia, Alcatel-Lucent Shanghai Bell, Huawei, HiSilicon, Qualcomm, CATT, Samsung

Agreement:

- IFDMA Sequence Design for RFP=2,
  - New lengths larger than 36 are supported. The corresponding DMRS sequences are generated by the legacy mechanism by extension of a Zadoff-Chu sequence.
  - FFS: whether new lengths of 6, 18, 30 are supported

7.2.4.2 CSI reporting

7.2.4.2.1 Non-precoded CSI-RS codebooks

At least decide on:

- *Down selection of (N1, N2) and/or (O1, O2) configurations*

R1-166272 Non-precoded CSI-RS Codebooks for eFD-MIMO Qualcomm Incorporated
R1-167954 Class A codebook design for eFD-MIMO ZTE Corporation, ZTE Microelectronics
Revision of R1-166323
R1-166342 Codebook Design for Class A CSI Reporting up to 32 Ports Nokia, Alcatel-Lucent Shanghai Bell
R1-166444 Reducing the number of combinations of codebook parameters CATT
R1-166445 Codebook design for {20,24,28,32} ports CATT
R1-166523 Discussion on Class A codebook extension Intel Corporation

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R1-166729	View on class A codebook extension	Samsung
R1-167639	On 1D antenna port layouts in Rel-14	Ericsson
R1-167140	Codebook for up to 32 ports CSI-RS	Huawei, HiSilicon

R1-168065 Way Forward on 1D Antenna Port Layouts Ericsson, Verizon, Kathrein-Werke, Deutsche Telekom, AT&T

Proposal:

- The following 1D antenna layouts are supported:
  - (N1,N2) = (16,1), (14,1) , (12,1), (10,1)

R1-166522	Performance evaluation of Class A codebooks with 32 ports	Intel Corporation
R1-166843	Discussions on non-precoded CSI-RS codebook design for eFD-MIMO	LG Electronics
R1-167348	Codebook Enhancement for eFD-MIMO	NTT DOCOMO, INC.
R1-166579	Discussion on codebook design to support up to 32 ports CSI-RS	Beijing Xinwei Telecom Techn.
R1-167638	Antenna port layout support for up to 32 Ports in Rel-14	Ericsson

R1-168353	Way Forward on Antenna Port Layouts	Ericsson, Qualcomm, Intel, CATT, AT&T, NTT DOCOMO
R1-168511	Way Forward on Antenna Port Layouts	Ericsson, QUALCOMM, Intel, CATT, ATT, DOCOMO, Verizon

- Simplify 1D configuration
  - Drop the (1,N2) rows (with red text)
    - Single design can be used for (N1,1) and (1,N2).
- Reduce UE computational complexity
  - Remove (8,8) combinations for 20, 24, 28, 32 ports (with green text)
    - Reduces number of beams by 2
    - Limited performance gain from (8,8) vs. (8,4)

Number of CSI-RS antenna ports, P	(N1,N2)	(O1, O2)
20 ports	(2,5)	(8,4), (8,8)
	(5,2)	(8,4), (4,4)
	(10,1)	(4,-),(8,-)
	(1,10)	(-,4),(-,8)
24 ports	(3,4)	(8,4), (8,8)
	(4,3)	(8,4), (4,4)
	(2,6)	(8,4), (8,8)
	(6,2)	(8,4), (4,4)
	(12,1)	(4,-),(8,-)
	(1,12)	(-,4),(-,8)
28 ports	(2,7)	(8,4), (8,8)
	(7,2)	(8,4), (4,4)
	(14,1)	(4,-),(8,-)
	(1,14)	(-,4),(-,8)
32 ports	(8,2)	(8,4), (8,8)
	(2,8)	(8,4), (4,4)
	(4,4)	(8,4),(4,4)
	(16,1)	(4,-),(8,-)
	(1,16)	(-,4),(-,8)

- The main concern of some companies is that the necessity or the complexity of all or a large group of codebook combinations is not justified by evaluation yet. Rel 13 does not support all possible layouts.
- However some UE vendors state that the complexity of codebook combination at the UE side is not a major issue. It is still an open question which codebook combination(s) are concerns.
- It is encouraged to indentify the problem or concern or redundancy for specific codebook combination(s).

Email discussion until the next meeting – Mark (Ericsson)

7.2.4.2.2 CSI reporting for hybrid CSI-RS

At least decide on:

- *Confirm working assumption of mechanism 1*
- *Additional mechanisms, if needed*
- *Reported CSI parameters, e.g. RI in the first and/or second report*

Petitioners' Exhibit 1007, p. 1669
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R1-168282 WF on hybrid CSI reporting LG Electronics, Samsung, LG Uplus, KT Corporation, ITRI, NTT Docomo, ITL, Ericsson, Xinwei, NEC, InterDigital

Agreement

- Confirm the working assumption of hybrid CSI
- Further details on Mechanism 1
  - Reporting content
    - For the 1st eMIMO-Type (CLASS A), $i1^{(1)}$ and x-bit $RI^{(1)}$ are reported, while $CQI^{(1)}$ and $i2^{(1)}$ are not reported
      - If UE supports up to 2 layers, x=0
      - If UE supports up to 8 layer, x=1 where $RI^{(1)}=\{1, 3\}$
    - For the 2nd eMIMO-Type (CLASS B K=1), $CQI^{(2)}$, $PMI^{(2)}$, $RI^{(2)}$ are reported
    - Note: Superscript (y) represents the y-th eMIMO-Type, where y=1,2.
    - FFS: Option for one eMIMO-Type to inherit RI reporting from another eMIMO-Type
  - **Working assumption**: No inter-dependence between CSI calculations across two eMIMO-Types
  - Reuse legacy CSI reporting mechanisms with the following refinement
  - For PUCCH-based P-CSI
    - Report $i1^{(1)}$ and $RI^{(1)}$ in one subframe
      - FFS: Using either PUCCH format 2 or 3
    - Periodicity of the CSI of 1st eMIMO-Type is an integer multiple of $RI^{(2)}$ periodicity of the 2nd eMIMO-Type.
    - Subframe offset of the 1st eMIMO-Type is defined relative to $RI^{(2)}$ subframe offset of the 2nd eMIMO-Type.
      - FFS: Whether subframe offset of the 1st eMIMO-Type can be fixed to 0
    - Priority rule for collision handling is FFS.
  - For PUSCH-based A-CSI
    - FFS: what CSI(s) will be reported from UE when aperiodic CSI reporting is triggered
      - Option 1: UE reports both CSI of 1st eMIMO-type and CSI of 2nd eMIMO-type.
      - Option 2: UE reports either one of the 2 eMIMO-types.
    - CSI encoding/mapping mechanisms is FFS.

Support of at least one more mechanism

R1-168286 WF on Hybrid CSI Reporting NTT DOCOMO, KT corporation, ITL, KDDI, LG Electronics, Mitsubishi Electric, NEC, Samsung, Sharp, Softbank, Sony, Straightpath

R1-168339 Way Forward on Inclusive Hybrid CSI-RS Framework Ericsson, ZTE Corporation, ZTE Microelectronics, Nubia, Xinwei, ITRI, ASTRI

Conclusion:

- **Proposal I:** For hybrid CSI with one CSI process, support CLASS B with K>1 CSI-RS resources for the 1st eMIMO-Type and CLASS B with K=1 CSI-RS resource for the 2nd eMIMO-Type
  - For the 1st eMIMO-Type, two options
    - Option 1: CRI (without CQI/PMI/RI) is reported
    - Option 2 (only support K=2): PMI assuming RI=1 for each of the two CSI-RS resources are reported
  - For the 2nd eMIMO-Type
    - CQI/PMI/RI are reported
  - Working assumption: No interdependence in CQI calculation between 1st and 2nd eMIMO-Types
    - FFS: for option 1, dynamic CSI-RS resource configuration for the 2nd eMIMO-Type based on CRI reporting 1st eMIMO-Type.
- **Proposal II:**
  - Hybrid CSI reporting with eMIMO-Type pairs is supported
    - No restriction on the configuration for 1st and 2nd eMIMO-Types
    - UE supports eMIMO-Type pairs
    - For TM9, different CSI-RS resources and/or CSI reporting configurations can be used for PUCCH and PUSCH
    - UE calculates one CSI report for only one eMIMO-Type of a pair at a time and one eMIMO-Type at a time
      - FFS: Define the period of CSI-RS associated with the 1st eMIMO-Type as N times of the period of CSI-RS associated with the 2nd eMIMO-Type, where N>1
        - Configurable or fixed value of N needs to be specified

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- Whether new dropping rules need to be specified
- Rel-13 CSI process configurations are supported
- A report for either eMIMO-type contains all Rel-13 CSI parameters (CQI/PMI/RI/CRI)

– Study whether it is possible to simplify a combination, or to down select, between/within proposals I and II

R1-166343	Hybrid CSI Reporting Schemes based on Single CSI Process	Nokia, Alcatel-Lucent Shanghai Bell
R1-166446	Further considerations on CSI reporting for hybrid CSI-RS	CATT
R1-166731	Supported schemes for hybrid CSI	Samsung
R1-166844	Discussion on CSI reporting enhancements for hybrid CSI-RS	LG Electronics
R1-167640	Hybrid CSI Reporting with One and Two CSI Processes	Ericsson
R1-166142	Hybrid CSI reporting in one CSI process	Huawei, HiSilicon
R1-166273	Discussion on CSI reporting for hybrid CSI-RS	Qualcomm Incorporated
R1-166327	Discussion on CSI reporting for hybrid CSI-RS	ZTE Corporation, ZTE Microelectronics
R1-166580	Further discussion on hybrid CSI report for eFD-MIMO	Beijing Xinwei Telecom Techn.
R1-166730	Hybrid PMI codebook based CSI reporting and simulation results	Samsung
R1-167349	CSI reporting for hybrid CSI-RS	NTT DOCOMO, INC.
R1-167406	Discussion on CSI reporting for hybrid CSI-RS	ITRI
R1-167641	Performance of Hybrid CSI-RS with Large CSI-RS Overhead	Ericsson

7.2.4.2.3 Advanced CSI reporting and interference measurement

At least decide on:

- *Select one advanced CSI scheme (combination-based codebook enhancement vs. channel quantization)*
- *The need for interference measurement enhancement*

Framework

R1-167971 WF on Advanced CSI feedback framework in Rel-14 Huawei, HiSilicon, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, CATT, ZTE, NTT DOCOMO, Qualcomm, Intel, InterDigital, ITRI

Agreement:

- Specify CSI feedback enhancement with the following advanced CSI feedback framework:
  - Reduced space (eigenvectors)/W1 is constructed based on one of the following alternatives (TBD RAN1#86bis):
    - Alt1. Orthogonal basis (e.g. orthogonal DFT matrix)
    - Alt2. Non-orthogonal basis (e.g. Rel.13 Class A W1 for rank-1 and/or 2)
  - Reduced space representation/W2 is to further combine selected beams
  - Granularity of weighting(phase and/or amplitude) can be either wideband only or wideband/subband, and is constructed based on one of the following alternatives (TBD RAN1#86bis):
    - Alt1. Phase and amplitude
    - Alt2. Phase-only weighting
  - How the enhanced framework can be applicable for Class A and/or Class B eMIMO-Types is FFS
  - FFS: How to handle the relationship between advanced CSI feedback and legacy CSI feedback framework
- Companies are encouraged to provide results comparing the above alternatives, considering a mix of smaller and larger numbers of ports within the following antenna port configurations
  - {4,8,12,16,20,24,28,32} ports
  - Focus on rank<=2 scenario MU-MIMO for evaluation
  - Feedback overhead needs to be taken into account
  - For {4,8,12,16, 20,24,28,32}-port scenario, companies are encouraged to compare their proposals to dual-stage codebook enhancement with increased number of beams in W1

R1-166845	Performance evaluation on advanced implicit CSI	LG Electronics
R1-167645	W1 design for implicit advanced CSI reporting	Ericsson
R1-166734	Linear combination (LC) codebook based CSI reporting and simulation results	Samsung

Codebook enhancement vs. channel quantization

R1-166139	Advanced CSI feedback framework for LTE	Huawei, HiSilicon
R1-166736	Comparison between implicit and explicit feedback	Samsung

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R1-167643 Explicit versus implicit feedback for advanced CSI reporting Ericsson

R1-168323 WF on Advanced CQI Measurement and Report NTT DOCOMO, Qualcomm

R1-166140 Uplink control channel enhancements for advanced CSI feedback Huawei, HiSilicon
R1-166274 Discussion on advanced CSI reporting and initial evaluation results Qualcomm Incorporated
R1-166322 Discussion on the design of linear combination codebook ZTE Corporation, ZTE Microelectronics
R1-166330 Discussion on interference measurement for MU-CSI ZTE Corporation, ZTE Microelectronics
R1-166447 On analog CSI feed back CATT
R1-166448 Discussion on advanced CSI reporting and interference measurement enhancement CATT
R1-166524 Further study of advanced CSI feedback Intel Corporation
R1-166525 Beam combining codebook enhancements for FD-MIMO Intel Corporation
R1-166526 Discussion on the performance of CQI reporting based on the NZP CSI-RS Intel Corporation
R1-166581 Advanced CSI feedback and simulation results Beijing Xinwei Telecom Techn.
R1-166656 Considerations on MU-CQI transmission Sony
R1-166732 Discussions on periodic CSI reporting for class A in eFD-MIMO Samsung
R1-166733 Discussions on interference measurement enhancement in eFD-MIMO Samsung
R1-166735 LC based explicit CSI feedback and simulation results Samsung
R1-167093 Enhancing interference measurement for MU transmissions CMCC
R1-167134 Uplink control channel enhancements for reduced space CSI feedback Huawei, HiSilicon
R1-167135 Superposition codebook for Class A CSI feedback Huawei, HiSilicon
R1-167136 Superposition codebook for Class B CSI feedback Huawei, HiSilicon
R1-167350 Enhancements on MU Interference Measurement and MU-CQI Reporting NTT DOCOMO, INC.
R1-167642 Discussion on Interference Measurement Enhancements Ericsson
R1-167644 On the need for W1 enhancements for advanced CSI Ericsson
R1-167674 Enhanced interference measurement Huawei, HiSilicon

R1-168504 WF on interference measurement in Rel-14, Huawei, HiSilicon, CATT, Samsung, Xinwei
- Specify interference measurement enhancements in Rel-14.

Conclusions:
- Whether the need of interference measurement enhancement in Rel-14 shall be decided in next meeting.
- If needed, one or more schemes shall be supported in Rel 14. Possible schemes are:
  - Definition and configuration of a new type interference measurement
    - Interference measurement is based on cancellation of intended signals
    - Both inter-cell and intra-cell interference should be captured
    - FFS NZP CSI-RS or DMRS as CSI-IM or PDSCH
  - Definition and configuration of a new type interference measurement
    - Only intra-cell interference to be measured using NZP
  - Aperiodic CSI-IM, based on
    - The existing CSI-IM
    - The new CSI-IM type (see above, if specified).
  - New UE measurement behavior for CQI reporting based on DMRS ports when corresponding PDSCH is transmitting.
  - If needed, L1/RRC signaling to assist UE interference measurement
  - Other schemes are not excluded.

Conclusions:
- Companies are encouraged to investigate the usage of new or existing PUCCH format for the purpose of analog feedback to carry advanced CSI.

7.2.4.3 DMRS-based open-loop and semi-open-loop transmission

At least decide on:
- *CSI parameters to be reported*
- *Down selection of Tx enhancement scheme, if needed*

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R1-168446 WF on semi-open-loop transmission Samsung, Nokia, ASB, ZTE, ZTE Microelectronics, CATT, KT Corporation

Agreement:
- Support both CLASS A and CLASS B with K≥1 CSI-RS resources for the eMIMO-Type of semi-open-loop
  - For dual-stage codebook,
    - RI, i_1 and CQI reporting is supported for {CLASS A} and {CLASS B with K=1 and 8Tx/alternate 4Tx codebooks}
      - FFS: reporting i11 and/or i12 for Class A codebooks
    - CRI, RI, i_1 and CQI reporting is supported for CLASS B with K>1
    - FFS: reporting i1 and subsampled i2
    - FFS: Hybrid CSI with semi-open-loop
    - FFS: Reporting multiple CRIs for CLASS B K>1
  - For single-stage codebook with 2 and 4 ports (CLASS B with K>1), CRI, RI and CQI are reported
  - For single-stage codebook with 2 and 4 ports (CLASS B with K=1), RI and CQI are reported
- Support RE level transmitter operation on PDSCH for both CSI reporting and PDSCH transmission
  - Down selection from the following transmission schemes in RAN1#86bis, including possible combination
    - Precoder cycling
    - Tx diversity
    - LD-CDD
    - Layer Permutation

R1-168048 WF on DMRS-Based Open-Loop/Semi-Open-Loop CATT, Nokia, Alcatel-Lucent Shanghai Bell, CATR, Huawei, HiSilicon, InterDigital, Intel, Qualcomm

Conclusion:
- RAN1#86bis: companies need to justify the need for introducing new DMRS pattern(s) to support open-loop/semi-open-loop transmission scheme. Otherwise the proposal in R1-168048 is agreed.

R1-166275 Discussion on DMRS based OL and Semi-OL Transmission Qualcomm Incorporated
R1-166328 DMRS-based Semi-Open-Loop Transmission ZTE Corporation, ZTE Microelectronics
R1-166344 DMRS-based Semi-open Transmission Schemes Nokia, Alcatel-Lucent Shanghai Bell
R1-166449 Transmission scheme for OL-MIMO CATT
R1-166450 CSI feedback for OL-MIMO CATT
R1-166527 Remaining details of open loop techniques Intel Corporation
R1-166737 Discussions on open and semi-open loop transmission in eFD-MIMO Samsung
R1-166738 Simulation results for precoder cycling based on semi-open-loop transmission Samsung
R1-166846 Initial performance evaluation on semi-OL MIMO LG Electronics
R1-167351 Enhancements for DMRS-based semi-open-loop MIMO schemes NTT DOCOMO, INC.
R1-167646 DMRS-based Open-loop MIMO Design Ericsson
R1-167676 DMRS based open loop transmission Huawei, HiSilicon
R1-167807 Evaluations on DMRS based Semi-open loop MIMO schemes CEWiT

7.2.5 Downlink Multiuser Superposition Transmission for LTE

WID in RP-161019

R1-168406 Chairman's Notes of Agenda Item 7.2.5 on Downlink Multiuser Superposition Transmission for LTE Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed

7.2.5.1 Superposition transmissions

Power ratios, modulation, etc

Power ratio
R1-166185 Further discussion on power ratios for MUST Huawei, HiSilicon
R1-166277 Power ratio set considerations for MUST Qualcomm Incorporated
R1-166847 Discussion on power ratio and modulation order LG Electronics
R1-167508 Selection of power ratios for MUST Case1 & 2 MediaTek Inc.

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R1-167689 MUST Case 1 and 2 transmission schemes Nokia, Alcatel-Lucent Shanghai Bell

R1-168141 Way forward on Power Ratios ZTE, ZTE Microelectronics, MediaTek, ITRI
R1-168152 WF on power ratios for MUST Case 1/2 Nokia, ASB, Qualcomm
R1-168316 Way Forward MUST power ratios Huawei, HiSilicon, MediaTek

Agreement:
- For Case 1/2, numbers of power ratios should be decided based on system level simulation and analysis:
  - For QPSK + QPSK, number of power ratios is to be selected from 2/3/4
  - For QPSK + 16 QAM, number of power ratios is to be selected from 2/3/4
  - For QPSK + 64 QAM, number of power ratios is to be selected from 1/2/3/4

Conclusion:
Companies are encouraged to provide principle of generating power ratio, examples are:
- Super-constellation/grid coordinates
  - Supported: Huawei, HiSilicon, Qualcomm, MediaTek, Nokia, ASB, KT
- Evenly spaced
  - Supported: ZTE, Mediatek, LG

Note that final selection of power ratios can be a combination of the above examples.

R1-168280 Way Forward on the Gray conversion LG Electronics, ZTE, ZTE Microelectronics, Huawei, HiSilicon
Agreements:
- For Gray-mapped composite constellation:
  - Alt 1: Bit-level Gray conversion is specified
  - Alt 2: Symbol-level Gray conversion is specified
  - Alt 3: up to implementation (where the bits are mapped to the composite-constellation)
- Down-select one alternative till next meeting

R1-168142 Way forward on MUST Transmission ZTE, ZTE Microelectronics, MediaTek, Sharp
Continue discussion next meeting

R1-168279 Way Forward on MUST UE multiplexing Huawei, HiSilicon
Proposals:
- In all PDSCH REs, the composite constellation symbols transmitted in a given sub-frame and a given spatial layer to a same MUST-near UE carry the same number of MUST-near UE codeword bits

Continue discussion next meeting

R1-167121 Discussion on superposition transmission Intel Corporation
R1-167363 Discussion on power ratios optimization for MUST scheme NTT DOCOMO, INC.
R1-166424 Simulation for power ratio down selection ZTE
R1-167408 Discussion on Power Ratios for MUST Case 1&2 ITRI
R1-167775 On Considerations of Power Ratios for MUST KT Corp.

R1-166276 Superposition transmissions Qualcomm Incorporated
R1-166425 Specification for joint modulation Gray mapping ZTE
R1-166848 Discussion on Gray mapping for superposed constellation LG Electronics
R1-167131 MUST UE multiplexing and resource allocation Huawei, HiSilicon
R1-167407 Discussion on EVM constraint for MUST Case1&2 ITRI
R1-167511 On power allocation for MUST MediaTek Inc.
R1-167845 Design issues of MUST with HARQ National Taiwan University

7.2.5.2 Mechanisms for efficient operation

Related RRC signaling, DCI, UE blind detection etc.

R1-166186 Discussion on signaling design for MUST Huawei, HiSilicon
R1-166278 Mechanisms for efficient operation Qualcomm Incorporated
R1-166279 MUST UE pairing with existing CQI feedback Qualcomm Incorporated
R1-166426 Mechanism for MUST operation ZTE
R1-166451 Support of downlink superposition transmission CATT
R1-166646 Power control and configuration for MUST NEC
R1-166647 New DCI design for MUST NEC
R1-166849 Discussion on Signaling Assistance Information and remaining issues LG Electronics

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R1-167094 On signaling design for MUST case 3 CMCC
R1-167122 On downlink control signalling for MUST Intel Corporation
R1-167167 Demodulation performance for MUST far UE Huawei, HiSilicon
R1-167364 Discussion on remaining issues and signaling design for DL MUST NTT DOCOMO, INC.
R1-167443 Power ratio and assistance information for MUST case 1 and case 2 China Telecommunications
R1-167513 On scheduling constraints for MUST operation MediaTek Inc.
R1-167514 Supported TMs for MUST MediaTek Inc.
R1-167610 Signaling for MUST SHARP Corporation, MTI
R1-167688 On network assistance and operation of MUST Nokia, Alcatel-Lucent Shanghai Bell

R1-168328 Way Forward on MUST DCI Design for Case 1&2 Qualcomm, Nokia, ABS, NEC
Agreement:
- Consider the following options for providing MUST-near UE co-schedule information
  - Alt 1. Single DCI by adding bits in the self DCI
    - FFS details (particularly regarding RA alignment)
  - Alt 2. Use common companion DCI to carry all MUST-far UE information
    - FFS details (particularly regarding RA alignment)
  - Alt3. Use user-specific companion DCI to carry all MUST-far UE information within near-UE allocation
    - FFS details (particularly regarding RA alignment)
  - Other alternatives are not precluded
  - FFS the number of blind decodes
- Down-select one option until next meeting

R1-168241 Way Forward on MUST Assistance Information in Cases 1 and 2 MediaTek, Huawei, HiSilicon, NTT DOCOMO, CMCC
Agreements:
- The following assistance information is provided to MUST-near UE
  - For CRS based transmission schemes in MUST Case 1, the information of "existence of MUST interference" and "power ratio" is provided for each spatial layer
  - For MUST Case 2, "existence of MUST interference" and "power ratio" are signaled
  - FFS: how to signal "existence of MUST interference" (particularly the granularity) and "power ratio"

R1-168317 Way Forward on signaling design for MUST new DCI Huawei, HiSilicon, Media Tek, China Telecom, NTT DOCOMO, LG Electronics
R1-168149 WF on the Design Principle for a new DCI LG Electronics, MediaTek, Huawei, HiSilicon
Agreements:
- A new DCI should follow the design principles
  - In addition to assistance information, all legacy DCI contents should be able to be signaled to MUST UE.

R1-168376 WF on the number of MUST layers for Case 3 LG Electronics, MediaTek
Continue discussion next meeting

R1-168336 Way forward on for Case 3 ZTE, ZTE Microelectronics, Qualcomm, Sharp
Agreements:
- For DMRS based Case 3, support multiuser superposition transmission with orthogonal ports
  - FFS non-orthogonal ports

R1-168150 WF on PDSCH starting symbol LG Electronics, MediaTek
Agreements:
- The starting symbol of interfering PDSCH to be canceled or suppressed should be provided to MUST UE by one of the following the two options:
  - Option 1: it should be blindly detected or signaled (assuming potentially different starting symbols)
  - Option 2: MUST UE assumes the same starting symbol of interfering PDSCH as its own PDSCH
- Down-selection till next meeting

7.2.5.3 Evaluation for MUST using up to 8Tx

Conclude evaluation etc.

Evaluations
R1-166427 Discussion and evaluation for MUST Case 3 ZTE
R1-167095 Non-full buffer Evaluation for MUST case 3 DMRS-based TM CMCC
R1-167690 System-level Evaluation of Case 3 MUST Nokia, Alcatel-Lucent Shanghai Bell
R1-167515 System-level evaluation for MUST Case 3 MediaTek Inc.

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R1-168291 WF on MUST supported TMs CMCC, Nokia, ASB, MTK, ZTE
Agreements:
- DMRS-based Case 3 is supported in
  - TM 8/9/10

Conclusion:
- Case 1&2 using up to 4Tx is not supported in DMRS-based TM

Possible working assumption:
- CRS-based Case 3 using 2Tx and 4Tx is supported in TM 4
  - Supported by: Nokia, ASB, ZTE, MTK, CMCC
  - Objected by: Huawei, HiSilicon, LG
  - Companies are encouraged to bring more results to confirm/abandon the WA.

Continue discussion next meeting

R1-168144 Way forward on Mechanism for Case 3 ZTE, ZTE Microelectronics, Qualcomm, Sharp

R1-167365 Evaluation for CRS-based MUST with 4 Tx antennas NTT DOCOMO, INC.

7.2.5.4 Others

R1-166187 Implementation for MUST transmitter Huawei, HiSilicon

7.2.6 eMBMS enhancements for LTE

WID in RP-161297
R1-168407 Chairman's Notes of Agenda Item 7.2.6 on eMBMS enhancements for LTE Session Chairman (Nokia)
Contents incorporated below
Endorsed

7.2.6.1 Longer cyclic prefix for MBSFN subframe

R1-167090 Background Information on Inter-site Distances BBC

R1-167749 Link level simulation assumptions Huawei, HiSilicon
Note that delays in Table 1 should be a factor of 10 larger.

R1-168070 Summary of email discussion Ericsson

R1-166177 Evaluations of longer CP for eMBMS Huawei, HiSilicon
R1-166280 System level Evaluation results for longer cyclic prefix Qualcomm Incorporated
R1-167841 System simulation results for longer CP in MBSFN subframes Ericsson
R1-166281 Design options for longer cyclic prefix and link level simulation results Qualcomm Incorporated

R1-166528 Considerations on longer cyclic prefix for MBSFN subframes Intel Corporation

R1-167842 MBSFN reference signal design Ericsson

R1-168366 WF on eMBMS Enhancements Qualcomm, Ericsson, BBC, EBU, Nokia, ASB, Dish, AT&T, Telstra, Fraunhofer IIS, Verizon, Telefónica, Intel
Also supported by Nomor
Agreement:
- A single new numerology with a CP of at least 100us and core symbol duration of at least 400us is introduced for PMCH
  - Working assumption that the CP length is 200us and core symbol duration of 800us.
  - Link level results may be provided at RAN1#86bis.
  - Working assumption then to be confirmed at RAN1#86bis.

Agreements in respect of at least objectives a, b and c:
- If a carrier is operated with 100% MBSFN subframe allocation, the new CP length and legacy extended CP for 15kHz subcarrier spacing are supported

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- It is understood that 100% MBSFN subframe allocation does not preclude some resources being set aside for e.g. cell search
  - FFS: Any SI that may be needed on this carrier will also be broadcasted in these subframes
  - In these subframes, FDM between PMCH and other channels (potentially with a different numerology) is not precluded.
- With the 100% MBSFN subframe confuguration, this carrier does not support unicast transmissions in the downlink
- This carrier can be configured without a unicast control region in a subset of the MBSFN subframes (including all of them)
  - The UE is not expected to receive PMCH with legacy extended CP for 15kHz subcarrier spacing in the MBSFN subframes without unicast control region
  - The UE is not expected to receive PMCH with the new CP in MBSFN subframes with unicast control region

- If a carrier is operated with less than 100% MBSFN subframe allocation, the new CP length and legacy extended CP for 15kHz subcarrier spacing are supported
  - This carrier has at least subframes 0 and 5 of each radio frame as non-MBSFN subframes
    - FFS: Further CRS reductions
  - This carrier can be configured without unicast control region in a subset of the MBSFN subframes (including all of them)
    - The UE is not expected to receive PDSCH/(E)PDCCH in the MBSFN subframes without unicast control region
    - The UE is not expected to receive PMCH with numerologies other than the new CP length in the MBSFN subframes without unicast control region
    - The UE is not expected to receive PMCH with the new CP length in MBSFN subframes with unicast control region
- eMBMS enhancements do not require changes to any channels and signals needed for MBMS operation except PMCH and MBSFN-RS
  - FFS whether use of more REs, TTI extension and/or change in payload are needed for PBCH coverage enhancements.

R1-168449 WF on the support of longer CP in MBSFN subframes Huawei, HiSilicon, Orange, ZTE
Proposal:
- Whether to introduce a new CP beyond the existing LTE CPs for eMBMS transmissions in Rel-14 should be concluded after the mapping of the SINR achievable with a 95% coverage probability to the corresponding MCS is agreed.

R1-168029 Draft LS regarding agreements for FeMBMS Qualcomm
Approved in R1-168200.

7.2.6.2 Increased number of MBSFN subframes per radio frame

R1-166193 Radio frame design for increased number of MBSFN subframes Huawei, HiSilicon
R1-166282 Increased number of MBSFN subframes per radio frame Qualcomm Incorporated
R1-167789 eMBMS cell support of PSS/SSS/PBCH Nokia, Alcatel-Lucent Shanghai Bell
R1-167843 Radio frame design for extended MBSFN subframe allocation Ericsson

R1-166529 Design guidelines to increase the number of MBSFN subframes per radio frame Intel Corporation

7.2.6.3 MBSFN subframes without a unicast control region and cell-specific reference signals

R1-167784 MBSFN subframe unicast control region considerations Nokia, Alcatel-Lucent Shanghai Bell
R1-167748 On MBSFN subframes without a unicast control region and cell-specific reference signals Huawei, HiSilicon
R1-166283 MBSFN subframes without a unicast control region and cell-specific reference signals Qualcomm Incorporated
R1-166530 On MBSFN subframes without a unicast control region and cell-specific reference signals Intel Corporation

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7.2.6.4 Others

R1-166284 Standalone eMBMS carrier Qualcomm Incorporated
R1-166285 Simultaneous reception of broadcast and unicast Qualcomm Incorporated

7.2.7 SRS Carrier Based Switching for LTE

WID in RP-160935

R1-168408 Chairman's Notes of AI 7.2.7 on SRS Carrier Based Switching for LTE Ad-Hoc Chair (Huawei)
Contents incorporated below
Endorsed with following updates

R1-168276 Way Forward on SRS Carrier-Based Switching Huawei, HiSilicon, SoftBank Corp.

7.2.7.1 SRS Transmission on TDD CCs without PUSCH

Including details for power control, timing advance, and possible new symbol positions

R1-166127 SRS symbol positions for SRS switching Huawei, HiSilicon
R1-166286 SRS Transmission on TDD CCs without PUSCH Qualcomm Incorporated
R1-166452 Further considerations on SRS carrier based switching CATT
R1-166531 On SRS transmission without PUSCH Intel Corporation

Agreements:

- No consensus to support in Rel-14 new SRS symbol position in addition to already agreed ones.

R1-167715 Power control for SRS switching Nokia, Alcatel-Lucent Shanghai Bell
R1-167485 Support of power control mechanism for SRS transmission in cells without configured PUSCH transmission Ericsson Inc.
R1-166128 Details on power control for SRS on TDD CCs without PUSCH Huawei, HiSilicon
R1-166739 SRS Transmission Aspects for Carrier Switching Samsung

Agreements:

- PC parameters
  - Configure open loop parameters Po and alpha for SRS-only CC
  - No need to have P_SRS_offset

- Down selection from TPC command options:
  - Option 1: by UL grant DCI 0/4 (with cross-carrier indication)
  - Option 2: by DL DCI (with cross-carrier indication)
  - Option 3: by group DCI

  - Adopt Option 3 and only apply to SRS-only CC without PUSCH
    - Joint group DCI for triggering and TPC
    - FFS: Number of bits for each UE and the meaning for the states of the field
    - Introduce RNTI for the group

- Support 2 types of PHR as in Rel-13
  - Details FFS
- Dropping/power scaling rules as in Rel-13

R1-167484 Support of non-contention based PRACH transmission Ericsson Inc.
R1-166129 Details on timing advance for SRS on TDD CCs without PUSCH Huawei, HiSilicon

Agreements:

- SRS-only CC without PUSCH needs to be configured in a TAG
- PRACH
  - PRACH trigger and SRS trigger for a SRS-only carrier are independent
  - Support all PRACH preamble formats

7.2.7.2 Details of periodic and/or aperiodic SRS

Petitioners' Exhibit 1007, p. 1678
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R1-166287 Details of Periodic and/or aperiodic SRS Qualcomm Incorporated
R1-166740 P-SRS and A-SRS Transmission with Carrier Switching Samsung

Agreements:
- For A-SRS, trigger is carried in:
  - DL scheduling DCI and group DCI
  - Group DCI is only used for SRS-only CC without PUSCH

- In addition to all existing parameter configurations
  - In case the UE supports multiple switching-from CCs, selected by
    - Option 1: rule(s) defined
    - Option 2: RRC configuration

R1-166130 Support of periodic SRS Huawei, HiSilicon
R1-167446 Further considerations on aperiodic SRS Ericsson Inc.
R1-166532 Remaing details of SRS triggering with CC switching Intel Corporation
R1-166131 Support of aperiodic SRS Huawei, HiSilicon

7.2.7.3 Details of collision handling

R1-166132 Details on collision handling for SRS switching Huawei, HiSilicon
R1-166288 Collision Handling Qualcomm Incorporated
R1-166533 Collision handling for SRS CC-based switching Intel Corporation
R1-166741 SRS Collisions in Carrier Switching Samsung
R1-167483 Impact of slot dropping in SRS switching Ericsson Inc.
R1-167757 Proposals on collision handling for SRS switching SoftBank Corp.

7.2.7.4 Others

R1-167716 SRS switching UE capability Nokia, Alcatel-Lucent Shanghai Bell

Agreements:
- UE reports the switching time/interruption time for SRS switching
  - FFS: Per band-pair or Per CC-pair
  - FFS: set of potential values

Agreements:
- R14 SRS switching supports RF retuning time no longer than X us
  - Option 1: X = 200
  - Option 2: X = 300
  - Option 3: X = 500
  - Option 4: X = 900

Agreements:
- Send LS to RAN4 and RAN2 with the agreements achieved during this meeting

R1-166289 Support of multiple antennas for SRS switching Qualcomm Incorporated
R1-166133 SRS switching for UEs with multiple antennas Huawei, HiSilicon

Agreements:
- Support SRS from each of the multiple antennas with carrier switching for periodic and aperiodic SRS
  - For 2 antenna cases, supported if UE is capable of UL 2x2 MIMO or 2 antenna switching
  - For 4 antenna cases, supported if UE is capable of UL 4x4 MIMO or 4 antenna switching (if introduced)
  - Details FFS

R1-168470 Draft LS for SRS Carrier-Based Switching Huawei
Agreed in R1-168556

7.2.8 Further Indoor Positioning enhancements for UTRA and LTE

WID in RP-160538

Petitioners' Exhibit 1007, p. 1679
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R1-168409 Chairman's Notes of Agenda Item 7.2.8 on Further Indoor Positioning enhancements for UTRA and LTE Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed with following updates

7.2.8.1 Remaining issues for OTDOA enhancements

R1-166290 PRS sequence generation and value range for PRS-IDQualcomm Incorporated
R1-166291 Introduction of UE inter-frequency RSTD calibration accuracy reporting Qualcomm Incorporated
R1-166950 OTDOA Enhancement for Same PCI Issue Nokia, Alcatel-Lucent Shanghai Bell
R1-166952 RSTD Reporting Enhancement in OTDOA Nokia, Alcatel-Lucent Shanghai Bell
R1-166958 OTDOA Enhancement for Same PCI Issue Nokia, Alcatel-Lucent Shanghai Bell
R1-167148 Discussion on the PRS sequence generation per TP Huawei, HiSilicon
R1-167415 Draft CR on PRS sequence generation per TP Huawei, HiSilicon
R1-167661 PRS sequence generation for same-PCI issue for enhanced indoor positioning Ericsson
R1-167662 Enhanced reference cell selection for enhanced indoor positioning Ericsson
R1-167663 Multipath RSTD reporting per cell for enhanced indoor positioning Ericsson
R1-167696 On range of virtual cell ID Intel Corporation
R1-167697 CRS Usage together with PRS Intel Corporation

R1-168266 WF on PRS sequence generation per TP Huawei, HiSilicon, Nokia, Alcatel-Lucent Shanghai Bell
R1-168447 [Draft] LS on PRS sequence generation per TP Huawei
Agreed in R1-168557

R1-168337 Draft CR on PRS sequence generation per TP Huawei, HiSilicon
R1-168086 Way forward on CRS usage together with PRS Intel Corporation, Acorn Technologies, Huawei, HiSilicon
Proposal:
- Support the use of CRS together with PRS for OTDOA enhancement
  - If CRS usage together with PRS is configured,
    - Signal CP information for CRS if PRS is present.
      - Note: this CP information signaling is additional one to the existing CP signaling for PRS.
    - Quasi-collocation between PRS and CRS is assumed.
- Send the LS for the above to RAN2 to be captured for their works

Study till next meeting

R1-168289 WF on Rich RSTD reporting for OTDOA Ericsson, Nokia, Qualcomm
Conclusion:
- RAN1 can further study the following for the OTDOA enhancement
  - Richer RSTD reporting by UE to E-SMLC

7.2.8.2 PRS-based beacons

R1-166292 PRS subframe configuration for PRS-based TBS Qualcomm Incorporated
R1-166293 PRS-only TBS Transmission PointsQualcomm Incorporated
R1-166954 Discussion of PRS-Based Beacon for Indoor Positioning Nokia, Alcatel-Lucent Shanghai Bell
R1-167664 PRS patterns for PRS-based TBS for enhanced indoor positioning Ericsson

R1-168297 WF on PRS-based TBS Qualcomm

R1-168466 [DRAFT] LS on PRS-based Terrestrial Beacon System (TBS) Qualcomm
Agreed in R1-168558

7.2.8.3 E-CID enhancements

R1-167170 WF on the same PCI for E-CID Huawei, HiSilicon, China Unicom
R1-167665 On CSI-RSRP reporting to E-SMLC for enhanced indoor positioning Ericsson
R1-167149 Further discussion on the same PCI case for E-CID enhancements Huawei, HiSilicon
Conclusion
- Companies are encouraged to study E-CID enhancements according to the WID, especially considering existing techniques (e.g., cell portion)

R1-167150 Further discussion on the UE Rx-Tx measurement over multiple serving cells Huawei, HiSilicon

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7.2.8.4 Others

R1-167666 Defining indoor/outdoor classification for enhanced indoor positioning Ericsson

7.2.9 Uplink Capacity Enhancements for LTE

WID in RP-160664

Specification of PUSCH in special subframe, with focus on the design of HARQ timing, TBS determination, UL DM-RS, TTI bundling, related signalling and procedure

R1-168410 Chairman's Notes of AI 7.2.9 on Uplink Capacity Enhancements for LTE Ad-Hoc Chair (Ericsson)
Contents incorporated below

R1-168396 [Draft] LS on introducing a new special subframe configuration CMCC
Agreed in R1-168559

R1-167100 Work plan for UL capacity enhancement CMCC
R1-166144 Scheduling and HARQ timing for PUSCH on UpPTS Huawei, HiSilicon
R1-166534 PUSCH transmission in special subframe Intel Corporation
R1-166294 PUSCH in UpPTS Qualcomm Incorporated
R1-166601 Considerations on PUSCH design in special subframe ZTE Corporation
R1-166635 TTI bundling for uplink coverage enhancement NEC
R1-167717 HARQ timing for PUSCH transmission in special subframe Nokia, Alcatel-Lucent Shanghai Bell

R1-167096 General Discussion on support of PUSCH in UpPTS CMCC
R1-166453 Support of PUSCH transmisison in UpPTS CATT
R1-166145 Signaling for PUSCH on UpPTS Huawei, HiSilicon
R1-166146 Transmission of PUSCH on UpPTS Huawei, HiSilicon
R1-166295 Control for PUSCH in UpPTS Qualcomm Incorporated
R1-167097 Timing for newly added PUSCH in UpPTS CMCC
R1-167098 Discussion on the TBS scaling design CMCC
R1-167099 Discussion on TTI bundling design for PUSCH in UpPTS CMCC
R1-167141 UCI in PUSCH on UpPTS Huawei, HiSilicon

R1-168096 WF on new special subframe configuration CMCC, ZTE, CATT
R1-168097 WF on timing design for PUSCH in UpPTS CMCC
R1-168098 WF on TTI bundling for PUSCH in UpPTS CMCC, NEC
R1-168099 WF on TBS scaling design for PUSCH in UpPTS CMCC

Agreement:

- Support a new special subframe configuration 10 as in the following table, with 6 DL symbols of NCP in DwPTS, together with 6 symbols of NCP in UpPTS or with 5 symbols of ECP in UpPTS

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
10	$13168 \cdot T_s$	$13152T_s$	$12800T_s$	-	-	-

- Send LS to RAN2 about the supported new special subframe configuration

Agreement:

- In UpPTS, independent transport block(s) is transmitted as a separate transmission resource

Agreement:

- Support synchronized HARQ timing
- For TDD UL/DL configuration 1~5, specify the timing from UL grant to PUSCH according to the following table, when supporting PUSCH transmission in UpPTS, i.e.,
  - *The UE shall upon detection of a PDCCH with DCI format 0/4 in subframe n intended for the UE, adjust the corresponding PUSCH transmission in subframe n+k, where the k is in the following table*

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TDD UL/DL Configuration	DL subframe index *n*									
	0	1	2	3	4	5	6	7	8	9
1	6	6			4	6	6			4
2		5		4			5		4	
3	4							4	4	4
4								4	4	4
5								4	4	

Agreement:
- For TDD UL/DL configuration 0, reuse the UL index field in UL grant to schedule PUSCH in UpPTS.

Agreement:
- For TDD UL/DL configuration 1~5, down-select between the following options for HARQ transmission:
  - Option1: Only support adaptive HARQ transmission, i.e., the retransmission of a PUSCH in UpPTS is scheduled by a UL grant with NDI not toggled
  - Option2: Support both adaptive and non-adaptive HARQ transmission. For non-adaptive HARQ transmission, the PHICH is used, and the PHICH timing is designed based on the following principle:
    - Principle: To keep the backward compatibility, the PHICH corresponding to PUSCH in UpPTS can only be added in DL subframes including legacy PHICH region
- FFS if non-adaptive HARQ transmission is supported for TDD UL/DL configurations 0 and 6

Agreement:
- Support TTI bundling for TDD configuration 2 and 3 when supporting of PUSCH in UpPTS
- Specify the scheduling and HARQ timing for TTI bundling as follows
  - The UE shall upon detection of a PDCCH with DCI format 0 in subframe n intended for the UE, adjust the corresponding PUSCH transmission in subframe n+k, with k in the following table

TDD UL/DL Configuration	DL subframe number *n*									
	0	1	2	3	4	5	6	7	8	9
2		5		4			5		4	
3	4							4	4	4

7.2.10 Further Enhanced MTC for LTE

SID in RP-161321

R1-168411 Chairman's notes of AI 7.2.10 on Further Enhanced MTC for LTE Ad-Hoc chair (Ericsson)
Contents incorporated below
Endorsed

R1-167667 WI work plan for Further Enhanced MTC for LTE Ericsson

7.2.10.1 Higher data rates

R1-166297 Support of larger data channel bandwidth Qualcomm Incorporated
R1-167892 Initial analysis on bandwidth and TBS increase for FeMTC Intel Corporation
Revision of R1-166536

Agreement:
- The wider bandwidth operation is enabled by eNB.
- Wider bandwidth PDSCH/PUSCH is cross subframe scheduled by MPDCCH.
- MPDCCH follows Rel-13 design, which implies that it can be decoded by a UE operating in narrowband operation (6RB).
- If a new grant is introduced for wideband PDSCH/PUSCH, the number of blind decodings of MPDCCH does not increase with respect to Rel-13 eMTC.

R1-166535 Views on support of higher data rates for FeMTC Intel Corporation
R1-167158 On supporting larger maximum TBS Huawei, HiSilicon
R1-168057 WF on support of larger maximum TBS and channel bandwidth for FeMTC Intel, Spreadtrum, Huawei, HiSilicon, Ericsson

Petitioners' Exhibit 1007, p. 1682
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Agreement:
- For Rel-14 FeMTC UEs, the maximum UL TBS for CEMode A UEs with maximum 1.4 MHz bandwidth in TDD/HD-FDD is increased to 2984 bits.
  - Idle mode operations reuse the Rel-13 eMTC design.
- Study till next meeting whether there are any issues with a maximum useable PDSCH/PUSCH channel bandwidth which is a multiple of 6 PRBs.
- For Rel-14 FeMTC UEs supporting larger UE channel BW for PDSCH and PUSCH:
  - The larger max. DL TBS is at least 2984 bits.
  - The larger max. UL TBS is at least 2984 bits.
- For Rel-14 FeMTC UEs with larger TBS and channel BW:
  - Idle mode operations reuse the Rel-13 eMTC design.

Agreement:
- For Rel-14 BL UEs in CE mode A (FFS for CE mode B), the single larger maximum UE channel BW for PDSCH and PUSCH in RRC connected mode is 5 MHz.
- For Rel-14 non-BL UEs in CE mode A (FFS for CE mode B), the single larger maximum UE channel BW for PDSCH and PUSCH in RRC connected mode is (FFS: 5 or 20) MHz.

R1-166298 Support of higher data rates Qualcomm Incorporated
R1-167319 Support of larger TBS and larger PDSCH/PUSCH bandwidth for MTC ZTE
R1-166625 Higher data rates for feMTC Sequans Communications
R1-167162 Analysis on increasing DL HARQ processes in CE mode A for FD-FDD Huawei, HiSilicon
R1-167352 Views on techniques to improve the data rate for Rel-14 MTC NTT DOCOMO, INC.
R1-166660 Higher data rate for feMTC Sony
R1-166680 Ack Bundling Design Consideration Sierra Wireless, S.A.

R1-166296 Support of HARQ-ACK bundling in HD-FDD Qualcomm Incorporated
R1-166596 Higher performance targets for Further Enhanced MTC Apple Europe Limited
R1-166602 Consideration on larger channel bandwidth for FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-166603 Increasing the number of HARQ processes in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-166628 Techniques for supporting high data rate transmission for FeMTC NEC
R1-166850 Higher data rate support for FeMTC LG Electronics
R1-167159 On improving peak rate for HD-FDD in FeMTC Huawei, HiSilicon
R1-167161 Discussion on larger Max PDSCH/PUSCH channel bandwidth in FeMTC Huawei, HiSilicon
R1-167195 Design for the higher data rates Kyocera Corporation
R1-167318 Support of HARQ-ACK bundling for MTC ZTE
R1-167418 Introduction of larger max TBS for MTC in TS36.213 Huawei
R1-167516 Discussion on Higher Data Rate for Further eMTC Lenovo
R1-167668 Higher data rates for MTC Ericsson
R1-166604 Achieving higher data rates in FeMTC Nokia, Alcatel-Lucent Shanghai Bell
R1-167417 Introduction of larger max TBS for MTC in TS36.212 Huawei

7.2.10.2 Multicast

R1-168166 WF on Multicast for FeMTC Nokia, Alcatel-Lucent Shanghai-Bell, Ericsson, Qualcomm

Proposal:
- All BL/CE UEs supporting SC-PTM, are able to decode the SC-MCCH even if it is configured for worst case CE Mode B operation and the UE is only a CE Mode A capable UE
- A cell supporting FeMTC SC-PTM, has the option to configure multiple parallel SC-MTCH services.
- FFS: A BL/UE UE can receive SC-PTM services in:
  - Idle mode only
  - Connected mode only
  - Either Idle or connected modes
- A MPDCCH search space is used to schedule the SC-MCCH.
  - Both dynamic and SPS-like scheduling are supported
  - FFS: If the SS reuses existing definition or is a new SS.
- A MPDCCH search space is used to schedule the SC-MTCH.
  - Both dynamic and SPS-like scheduling are supported
  - FFS: If the SS reuses existing definition or is a new SS.

R1-166299 Support of multicast Qualcomm Incorporated
R1-166605 SC-PTM for FeMTC General Considerations Nokia, Alcatel-Lucent Shanghai Bell

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R1-167160 Consideration on SC-PTM transmission for FeMTC Huawei, HiSilicon

R1-167320 Considerations on multicast support for MTC ZTE
R1-167670 Multicast support for MTC Ericsson
R1-166537 On multicast support for Cat M1 UEs Intel Corporation
R1-166606 SC-PTM for FeMTC Search Space Considerations Nokia, Alcatel-Lucent Shanghai Bell
R1-167669 Overview of SC-PTM and common eMTC and NB-IoT aspects Ericsson

7.2.10.3 Others

R1-166300 Paging channel enhancements Qualcomm Incorporated
R1-167612 Power consumption reduction techniques for eMTC Qualcomm Incorporated

R1-166607 VoLTE support for Cat-M1 UE Nokia, Alcatel-Lucent Shanghai Bell
R1-166851 VoLTE support for FeMTC LG Electronics
R1-166626 VoLTE considerations for HD-FDD Sequans Communications

7.2.11 Enhancements of NB-IoT

WID in RP-161324.
The objectives apply to the in-band, guard-band, and standalone operation modes and the same coverage enhancement targets as defined in the Rel-13 NB-IoT work item.
R1-168412 Chairman's Notes of Agenda Item 7.2.11 on Enhancements of NB-IoT Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed with following updates

R1-166189 NB-IoT Release 14 enhancements work plan Huawei, HiSilicon
Noted

7.2.11.1 Positioning

R1-168114 WF on observations on NB-IoT positioning performance Ericsson, ZTE
R1-168310 WF on simulation assumption for NB-IoT positioning ZTE, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell
Agreement:

- R1-168310 is agreed with the following updates:
  - Slide 3, add UL transmission timing error modelling according to RAN4 requirements

The above agreement is captured in R1-168363.

7.2.11.1.1 Requirements

R1-167743 Requirements for NB IoT Positioning Enhancements Evaluations VODAFONE Group Plc
R1-167101 Discussion on positioning requirements for enhanced NB-IoT CMCC
R1-167790 Requirements for NB-IoT/eMTC positioning Deutsche Telekom AG

R1-167983 WF on requirements for NB-IoT positioning Huawei, HiSilicon

Agreed way forward for reporting to RAN#73

- Report the horizontal accuracy and TOA estimation accuracy at 67%.
- Report the operator requirement to strive towards horizontal accuracy of 50 m for 67% of NB-IoT UEs
- Report observations on positioning accuracy for stationary (i.e., 0 km/h) and pedestrian (i.e., 3 km/h) and 30km/h UEs. 120km/h may be evaluated during the design.
- Report observations for outdoor channel models, and outdoor-indoor channel models where they are available.
- Report observations on time to determine position according to MCL
  - This is the time from trigger for positioning to availability of a positioning estimate
- Report observations on impact of having a lower power class UE
- Report observations on network complexity/cost, for example including LMUs (as described in 36.111)
- Other requirements as for Rel-13 NB-IoT, including
  - Report changes UE complexity compared to Rel-13 NB-IoT
  - Report total impact to UE battery life
  - Report scalability to support massive numbers of UEs per cell
- Report dependency of accuracy performance on synchronous (E-SMLC is assumed to know the absolute timing of each involved eNB) or asynchronous networks

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- Requirements are the same for all three operation modes (i.e. stand-alone/in-band/guard band) per the WID
- Companies can provide other inputs to RAN#73 on aspects outside the scope of RAN1 such as security, RAN sharing, etc.

R1-166171 NB-IoT positioning scenarios and requirements Huawei, HiSilicon
R1-166301 Requirements for narrowband positioning Qualcomm Incorporated
R1-167423 On requirements and assumptions for NB-IoT positioning Ericsson
R1-166587 NB-IoT positioning requirements Nokia, Alcatel-Lucent Shanghai Bell
R1-167321 Discussion of NB-IoT positioning requirement and evaluation methodology ZTE

R1-167424 A new system simulator for NB-IoT positioning Ericsson

7.2.11.1.2 Uplink-based narrowband positioning

R1-166173 Design of NB-IoT uplink positioning Huawei, HiSilicon
R1-166174 Evaluation of NB-IoT uplink positioning Huawei, HiSilicon
R1-166302 Uplink-based narrowband positioning Qualcomm Incorporated
R1-167322 UTDOA support for NB-IoT ZTE
R1-167425 On uplink-based positioning for NB-IoT Ericsson

R1-166588 UTDOA positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-166627 UTDOA based positioning for NB-IoT Fraunhofer IIS

R1-166994 Discussion on positioning method based on UTDOA for NBIoT Spreadtrum Communications
R1-167426 On timing advance based multi-leg positioning for NB-IoT Ericsson
R1-167691 Impact of transmit power on UTDOA-based positioning for NB-IOT Fraunhofer IIS

7.2.11.1.3 Downlink-based narrowband positioning

R1-167427 On Downlink-based narrowband positioning for NB-IoT Ericsson
R1-166303 Downlink-based narrowband positioning Qualcomm Incorporated
R1-166589 OTDOA positioning in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-167323 OTDOA support for NB-IoT ZTE
R1-166172 Evaluation of NB-IoT downlink positioning Huawei, HiSilicon
R1-166852 Positioning support for eNB-IoT LG Electronics
Section 3

R1-167163 Design of NB-IoT downlink positioning Huawei, HiSilicon
R1-167740 Discussion on OTDOA for eNB-IoT III
R1-167752 Support of OTDOA in NB-IoT Innovative Technology Lab Co.

7.2.11.1.4 Comparison of uplink- and downlink-based methods

R1-168332 WF on observations on performance aspects of NB-IoT positioning Huawei, HiSilicon
Revision of R1-167984
Agreement:
The WF is agreed with the following updates:

- Slide 5,
  - add “reusing of NPSS”
  - in ZTE’s result, adding [.] for the sampling rate of 1920
  - Update the sentence from
    - For in-band operation, the positioning accuracy of OTDOA schemes evaluated by RAN1#86 reported by most companies is on the order of tens of meters. One evaluation found accuracy on the order of a few hundred meters
      To
    - For in-band operation, the positioning accuracy of OTDOA schemes evaluated by RAN1#86 reported by most companies is on the order of tens of meters.
      - One evaluation found accuracy on the order of a few hundred meters, which is under assumptions of Rel-13 UE complexity
- Slide 3, update the sentence from

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- (this sentence is not staying here) Companies have used differing simulation assumptions, which leads to the performance differences between companies. Comparisons can be made within each company's results.

To

- Companies have used different assumptions, which leads to the significant performance differences between companies. Results from different companies may not be comparable

R1-168333 WF on observations on UE impact aspects of NB-IoT positioning Huawei, HiSilicon
Revision of R1-167985
R1-168334 WF on observations on network impact aspects of NB-IoT positioning Huawei, HiSilicon
Revision of R1-167986

LS to RAN plenary (cc-ing RAN2/3/4) capturing the above 3 agreements
R1-168552 [DRAFT]LS on NB-IoT positioning Huawei
Agreed in R1-168553

R1-166175 Comparison of downlink and uplink positioning Huawei, HiSilicon
R1-166176 UE complexity and power consumption analysis for NB-IoT positioning Huawei, HiSilicon, Neul
R1-166304 Comparison of uplink and downlink based positioning Qualcomm Incorporated
R1-166590 Comparison of UTDOA and OTDOA in NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
R1-166654 Considerations on NB-IoT positioning Sony
R1-167164 Capacity limit evaluation Huawei, HiSilicon
R1-167324 Comparison of NB-IoT positioning solution ZTE
R1-167428 On uplink- and downlink-based positioning for NB-IoT Ericsson
R1-167897 NB-IoT localization performance analysis and enhancement Nokia, Alcatel-Lucent Shanghai Bell
Revision of R1-167712 NB-IoT localization performance analysis and enhancement Nokia, Alcatel-Lucent Shanghai Bell

7.2.11.2 Multicast support

Extend Rel-13 SC-PTM to support multicast downlink transmission
R1-166178 Physical layer design for multicast in NB-IoT Huawei, HiSilicon
R1-167556 Discussion on SC-PTM in enhanced coverage MediaTek Inc.
R1-166199 Search space and collision handling for multicast in NB-IoT Huawei, HiSilicon
R1-166538 SC-PtM support for NB-IoT Intel Corporation
R1-166591 On Multicast support for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell

R1-167987 WF on collision handling for NB-IoT SC-PTM Huawei, HiSilicon, ITL
Agreement:

- SC-PTM in NB-IoT is supported at least in RRC_IDLE mode. FFS RRC CONNECTED mode.
- In RRC IDLE mode, priority between SC-PTM and the following needs to be decided at least for:
  - ✓ SC-PTM and paging, if there is a collision issue
  - ✓ SC-PTM and a random access procedure (e.g. for unicast BSR), if there is a collision issue
- If RRC_CONNECTED mode is supported, priority between SC-PTM and the following needs to be decided at least for:
  - ✓ SC-PTM and unicast, if there is a collision issue

R1-167988 WF on design principle of search space for NB-IoT SC-PTM Huawei, HiSilicon, ITL
Continue discussion next meeting

R1-166305 Support of multicast Qualcomm Incorporated
R1-166853 Multicast support for eNB-IoT LG Electronics
R1-167883 Physical-layer processing for multi-segment transmission in NB-IoT Huawei, HiSilicon
Revision of R1-167165 Physical-layer processing for multi-segment transmission in NB-IoT Huawei, HiSilicon
R1-167325 Consideration for multicast support for NB-IoT ZTE
R1-167354 Discussion on multicast support for Rel-14 NB-IoT NTT DOCOMO, INC.
R1-167429 Multicast support for NB-IoT Ericsson
R1-167753 Support of SC-PTM in NB-IoT Innovative Technology Lab Co., KT Corp.

7.2.11.3 Non-anchor PRB enhancements

Transmission of paging on non-anchor PRBs
R1-166306 Non-anchor PRB enhancements Qualcomm Incorporated
R1-168052 WF on Paging on non-anchor PRBs Qualcomm Incorporated
Also supported by Intel
R1-168062 WF on Paging enhancement for Rel-14 NB-IoT ZTE, Nubia
Also supported by ITL.

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Agreements:

- For paging:
  - For a Rel-14 NB-IoT UE, both anchor and non-anchor PRB can be selected as the paging PRB
    - A Rel-14 UE chooses the PRB based on UE_ID
  - Paging message on NPDSCH is scheduled by NPDCCH on the same PRB.
- Send LS to RAN2 with these RAN1 agreements

R1-168362 [DRAFT] LS regarding agreement on paging for NB-IoT Qualcomm
Agreed in R1-168554

R1-166854 Non-anchor PRB enhancements for eNB-IoT LG Electronics
Section 2
R1-167326 Considerations to support paging on multiple PRBs ZTE
R1-168344 Paging PRB configuration for eNB-IoT LG Electronics, ITL
Continue discussion next meeting.

R1-166179 On paging transmission on non-anchor NB-IoT PRB Huawei, HiSilicon
R1-166539 MCO enhancements for paging Intel Corporation

R1-166592 On non-anchor PRB enhancements for NB-IoT Nokia, Alcatel-Lucent Shanghai Bell
Section 4
R1-167353 Initial views on the paging on non-anchor PRB for Rel-14 NB-IoT NTT DOCOMO, INC.
R1-167430 NB-IoT non-anchor carrier Paging Ericsson

R1-167431 Random Access on Non-Anchor Carriers in NB-IoT Ericsson

7.2.11.4 Others

R1-166593 Scheduling request multiplexing with ACK/NACK Nokia, Alcatel-Lucent Shanghai Bell
R1-166855 Low power UE support for eNB-IoT LG Electronics
R1-167557 Support of higher data rate for NB-IoT MediaTek Inc

7.2.12 Shortened TTI and processing time for LTE

WID in RP-161299.
R1-168413 Chairman's Notes of Agenda Item 7.2.12 on Shortened TTI and processing time for LTE Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

R1-167502 Work plan for shortened TTI and processing time Ericsson
R1-167069 On LTE PHY processing time reduction Nokia, Alcatel-Lucent Shanghai Bell

7.2.12.1 Shortened processing time for 1ms TTI

General
R1-167366 Views on shortened processing time for 1ms TTI NTT DOCOMO, INC.
R1-167497 Reduced processing for 1ms TTI Ericsson
R1-167501 Supported HARQ timings for 1ms TTI Ericsson
R1-167891 Processing time reduction and related procedures for 1ms TTI Huawei, HiSilicon
Revision of R1-166159
R1-166540 On reducing processing time for 1ms TTI Intel Corporation
R1-166692 Overview of latency reduction operation with subframe TTI for FS1 Samsung
R1-166695 Processing time reduction for latency reduction with subframe TTI Samsung
R1-166856 Consideration for shortened processing time for 1ms TTI LG Electronics
R1-167017 On HARQ-timing with 1-ms TTI and reduced processing times Nokia, Alcatel-Lucent Shanghai Bell
R1-167582 Some issues in 1ms TTI latency reduction operation ZTE Corp, ZTE Microelectronics

R1-166995 Shortened Processing Time Analysis Spreadtrum Communications
R1-167084 Mechanism for indicating the processing time to the UE for 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-167577 HARQ with shortened processing time for 1ms TTI ZTE Corp, ZTE Microelectronics

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R1-167597 Considerations on processing time reduction for legacy TTIs Mediatek Inc.
R1-167611 Shortened processing time for 1ms TTI SHARP Corporation

Downlink
R1-166307 Shortened processing time for 1ms TTI for DL Qualcomm Incorporated
R1-167070 On processing time reduction between PDSCH transmission and DL HARQ feedback Nokia, Alcatel-Lucent Shanghai Bell
R1-166696 FDD DL HARQ-ACK feedback procedure for latency reduction with subframe TTI Samsung
R1-166454 HARQ and scheduling timing design for LTE processing timing reduction with 1ms TTI CATT

Uplink
R1-166308 Shortened processing time for 1ms TTI for UL Qualcomm Incorporated
R1-167071 On processing time reduction between UL grant and UL data transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-167500 Asynchronous HARQ for PUSCH Ericsson
R1-166698 UL HARQ-ACK feedback procedure for latency reduction with subframe TTI Samsung

FS2
R1-166693 Overview of latency reduction operation with subframe TTI for FS2 Samsung
R1-166697 TDD DL HARQ-ACK feedback procedure for latency reduction with subframe TTI Samsung
R1-167016 Latency reduction for FS2 with 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-167367 HARQ/Scheduling timing for FS2 with Shortened processing time for 1ms TTI NTT DOCOMO, INC.

FS3
R1-166694 Overview of latency reduction operation with subframe TTI for FS3 Samsung

Evaluations
R1-167083 System level study on processing time reduction with 1ms TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-167147 Performance evaluation of short TTI vs. 1ms TTI with processing time reduction Huawei, HiSilicon

CSI
R1-166857 Discussion on CSI feedback for 1ms TTI with reduced processing time LG Electronics
R1-167499 Fast CSI for 1ms TTI Ericsson

R1-168230 WF on Tx timing for 1ms TTI LG Electronics, NTT DOCOMO, Ericsson, Qualcomm, ZTE Corp, ZTE Microelectronics, Panasonic, Sharp, Nokia, Alcatel-Lucent Shanghai Bell
R1-168192 WF on support of reduced processing time for 1ms TTI Intel, Ericsson, Huawei, HiSilicon, LG Electronics, Panasonic, Samsung, Nokia, Alcatel-Lucent Shanghai Bell, Sharp, NTT DOCOMO

Agreement:
- For FS1,2&3, a minimum timing n+3 is supported for UL grant to UL data and for DL data to DL HARQ for UEs capable of operating with reduced processing time with only the following conditions:
  - A maximum TA is reduced to x ms, where x <= 0.33ms (exact value FFS);
  - At least when scheduled by PDCCH
- For FS2, new DL HARQ and UL scheduling timing relations will be defined
  - Details FFS
- FFS:
  - Possible minimum timing of n+2 TTI
    - FFS max TA in this case
    - FFS what other restrictions (if any) on when reduced processing times of n+2 could be applied
  - Possibility of scheduling by EPDCCH.

R1-168243 WF on n+2 transmission timing for 1ms TTI Nokia, ASB

R1-168231 WF on fallback transmission for shortened processing time in 1ms TTI LG Electronics, Sharp, Huawei, HiSilicon, Qualcomm, Ericsson, Intel, NTT DOCOMO
Also supported by Nokia
Proposal:
- For UE capable of shortened processing time for 1ms TTI, the following fallback operations should be supported:
  - If PDCCH for DL assignment is transmitted in the common search space, use legacy processing timing with a minimum timing of 4ms for DL data to DL HARQ feedback

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- If PDCCH for UL grant is transmitted in the common search space, use legacy processing timing with a minimum timing of 4ms for UL grant to UL data
- The above fallback operations are applied to both FS1 and FS2

Agreement:
- Reduced processing time(s) are RRC configured for the UE
- Working assumption: A mechanism for dynamic fallback to legacy processing timings (n+4) is supported
  - Details FFS
  - Working assumption can be revisited if it is not found to be feasible

R1-168187 WF on asynchronous UL HARQ Ericsson, Nokia, ASB

Agreement:
- PHICH-less asynchronous HARQ for UL is used for 1 ms TTI with shortened processing time
  - For FS1 and FS2, bit fields are defined in the applicable DCI messages to indicate HARQ processes ID and RV
  - No change in FS3 asynchronous UL HARQ operation

Asynchronous HARQ: QC, HW, HiSi, Ericsson, LGE, ZTE, Docomo, Nokia, ASB, Spreadtrum, Sharp
Synchronous HARQ: Samsung, CATT, ITRI,
Configurable by the network: Samsung, CATT, ITRI

R1-168261 WF on support of Synchronous UL HARQ Samsung
Proposal:
- PHICH-based synchronous HARQ for UL is supported for 1 ms TTI with shortened processing time for FS1 and FS2.
- For FS3, asynchronous UL HARQ is supported for 1 ms TTI with shortened processing time.

R1-168232 WF on PUCCH resource allocation for shortened processing time in 1ms TTI LGE

7.2.12.2 Shortened TTI length together with shortened processing time

7.2.12.2.1 Design of sTTI for DL and UL

R1-166143 Discussion on the HARQ issues for TTI length reconfiguration Huawei, HiSilicon
R1-166147 Discussion on sTTI length Huawei, HiSilicon
R1-166148 sPDCCH design for short TTI Huawei, HiSilicon
R1-166149 Details of two-level DCI schemes for short TTI Huawei, HiSilicon
R1-166150 Discussion on DCI design for short TTI Huawei, HiSilicon
R1-166151 PDSCH design for short TTI Huawei, HiSilicon
R1-166152 PUCCH design for short TTI Huawei, HiSilicon
R1-166153 PUSCH design for short TTI Huawei, HiSilicon
R1-166154 UCI on sPUSCH Huawei, HiSilicon
R1-166155 Discussion on DL RS for short TTI Huawei, HiSilicon
R1-166156 Discussion on UL RS for short TTI Huawei, HiSilicon
R1-166309 Dl design for shortened TTI Qualcomm Incorporated
R1-166310 UL design for shortened TTI Qualcomm Incorporated
R1-166455 sPDCCH design for LTE short TTI CATT
R1-166456 sPDSCH design for LTE short TTI CATT
R1-166457 sPUSCH design for LTE short TTI CATT
R1-166458 Discussion on UL sTTI operation CATT
R1-166459 sPUCCH design for LTE short TTI CATT
R1-166460 Discussion on the simultaneous transmissions of normal TTI and sTTI CATT
R1-166541 DCI formats for shorten TTI Intel Corporation
R1-166542 On sPDCCH design for shoten TTI Intel Corporation
R1-166543 UL channes design for shorten TTI Intel Corporation
R1-166629 sPDSCH/sPDCCH with 2-symbol sTTI and 1-slot sTTI NEC
R1-166661 Discussion on sPDCCH for shortened TTI Sony
R1-166699 Overview of sTTI operations Samsung
R1-166700 sDCI design for sTTI operations Samsung
R1-166701 sPDCCH for 2-symbol sTTI Samsung
R1-166702 sPDCCH for 1-slot sTTI Samsung
R1-166703 sPDSCH for 2-symbol and 1-slot sTTI Samsung

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R1-166704 sPUCCH for 2-symbol, 4-symbol and 1-slot sTTI Samsung
R1-166705 sPUSCH for 2-symbol, 4-symbol and 1-slot sTTI Samsung
R1-166706 TDD-specific issues on sTTI operations Samsung
R1-166707 Coexistence between subframe TTI and sTTI operations for DL and UL Samsung
R1-166858 Discussions on sPDCCH for latency reduction LG Electronics
R1-166859 Discussions on sPDSCH for latency reduction LG Electronics
R1-166860 sPUCCH design for HARQ-ACK feedback with shortened TTI length LG Electronics
R1-166861 sPUCCH design for CSI feedback with shortened TTI length LG Electronics
R1-166862 Discussion on UL design for shortened TTI LG Electronics
R1-166966 Discussion on single level DCI and two-level DCI Panasonic
R1-166968 UL simultaneous transmission between sTTI and TTI Panasonic
R1-166972 Discussion on reference signal design for shortened TTI Panasonic
R1-166973 Discussion on multiplexing between sTTI and TTI in the same subframe Panasonic
R1-166996 Discussion on sPDCCH design for sTTI Spreadtrum Communications
R1-166997 Discussion on sPUSCH design for sTTI Spreadtrum Communications
R1-167018 On requirements of DM-RS design for UL shorter TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-167019 Simultaneous Transmissions of UL Signals for Shortened TTI Operation Nokia, Alcatel-Lucent Shanghai Bell
R1-167021 sPUCCH design for shortened TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-167022 Considerations of slot-level sTTI for FS2 Nokia, Alcatel-Lucent Shanghai Bell
R1-167072 On simultaneous unicast PDSCH and sPDSCH operation Nokia, Alcatel-Lucent Shanghai Bell
R1-167081 On DL control channel design for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-167082 On two-level DL control channel design for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-167085 On details of DMRS design for DL shorter TTI Nokia, Alcatel-Lucent Shanghai Bell
R1-167102 Discussion on HARQ timing for shortened TTI in TDD CMCC
R1-167189 Discussion on CA issues for shortened TTI operation Huawei, HiSilicon
R1-167334 Discussions on DCI design consideration for shortened TTI SPS operation Beijing Xiaomi Mobile Software
R1-167368 sPDCCH for shortened TTI NTT DOCOMO, INC.
R1-167369 sPDSCH for shortened TTI NTT DOCOMO, INC.
R1-167370 sPUCCH for shortened TTI NTT DOCOMO, INC.
R1-167371 sPUSCH for shortened TTI NTT DOCOMO, INC.
R1-167486 DL DMRS design for TTI shortening Ericsson
R1-167487 sPDCCH search space design Ericsson
R1-167488 Design aspects of sPDCCH Ericsson
R1-167489 DL control for short TTI Ericsson
R1-167490 Design aspects of sPDSCH Ericsson
R1-167491 Design aspects of sPUSCH Ericsson
R1-167492 UCI on sPUSCH with short TTI Ericsson
R1-167493 Design aspects of sPUCCH Ericsson
R1-167495 TDD aspects of short TTI Ericsson
R1-167496 On the operation with different TTI lengths Ericsson
R1-167498 Asynchronous HARQ for UL retransmissions with short TTI Ericsson
R1-167503 Handling overlapping allocations with short and 1 ms TTI Ericsson
R1-167504 Puncturing sTTI in legacy TTI Ericsson
R1-167596 Considerations on short TTI design Mediatek Inc.
R1-167598 UL RS design for short TTI Mediatek Inc.
R1-167599 DL channel design for short TTI Mediatek Inc.
R1-167620 sPUCCH design for shortened TTI Potevio
R1-167628 Shortened TTI design Motorola Mobility
R1-167629 Multiplexing of Regular TTI and shortened TTI Motorola Mobility
R1-167654 On sPDCCH Design InterDigital Communications
R1-167655 On sPDSCH Design InterDigital Communications
R1-167656 On sPUCCH Design InterDigital Communications
R1-167658 On sPUSCH Design InterDigital Communications
R1-167774 Views on short PUSCH design KT Corp.
R1-167865 Discussion on sPDCCH for sTTI ZTE Corp., ZTE Microelectronics
R1-167866 Study on PDSCH transmission in sTTI ZTE Corp., ZTE Microelectronics
R1-167867 Study on PUSCH transmission in sTTI ZTE Corp., ZTE Microelectronics
R1-167868 PUCCH to carry HARQ-ACK for sTTI ZTE Corp., ZTE Microelectronics

R1-168350 WF on sPDCCH Huawei, HiSilicon,Qualcomm,Ericsson,Nokia,ASB,InterDigital,Xiaomi Communication, NTT DOCOMO,CATT, Samsung,Intel,LG,ZTE, ZTE Microelectronics, Spreadtrum,Sharp,CATR,Panasonic,Potevio, Mediatek, Motorola Mobility, Lenovo, NEC,SONY

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R1-168533 WF on UL DMRS for sTTI Huawei, HiSilicon, Nokia, ASB, Ericsson, Potevio, Qualcomm, CATT, Intel, Spreadtrum, LG, Mediatek, Samsung, ZTE, ZTE Microelectronics, NTT DOCOMO, Panasonic,Sony
R1-168500 WF on short TTI lengths LG Electronics, Ericsson, Intel, NTT DOCOMO, CATT, Sharp, Samsung, Huawei, HiSilicon, Qualcomm, ZTE Corp, ZTE Microelectronics, Nokia, Alcatel-Lucent Shanghai Bell, MediaTek, Panasonic, KT Corp
R1-168482 Way forward on search space for sTTI Ericsson, Huawei, HiSilicon, Intel, CATT, Panasonic, NTT DOCOMO, LG Electronics
Agreements:
- The DL sTTI length of a UE is indicated by eNB
  - FFS details of configuration (based on RRC or PDCCH)

R1-168188 WF on DCI monitoring for sTTI Ericsson
R1-168189 WF on search space for sTTI Ericsson, Huawei
R1-168194 WF on UL DMRS for sTTI Huawei
R1-168195 WF on sPDSCH and sPUSCH transmission Huawei
R1-168196 WF on sPUCCH Huawei
R1-168197 WF on sTTI patterns Huawei
R1-168233 LGE

7.2.12.2.2 Processing time

Including maximum TA, CSI processing and minimum data processing time

R1-166157 Discussion on CSI feedback for short TTI Huawei, HiSilicon
R1-166158 Processing time reduction and related procedures for short TTIHuawei, HiSilicon
R1-166311 Processing time reduction and related procedures for DL Qualcomm Incorporated
R1-166312 Processing time reduction and related procedures for UL Qualcomm Incorporated
R1-166313 TDD-specific design for shortened TTI Qualcomm Incorporated
R1-166461 HARQ and scheduling timing design for LTE short TTI CATT
R1-166708 Processing time reduction for sTTI operations Samsung
R1-166863 Consideration for shortened processing time for shortened TTI length LG Electronics
R1-166864 Discussion on HARQ timing with shortened TTI length LG Electronics
R1-166967 Evaluation results on processing time reduction in physical layer Panasonic
R1-167120 On the processing time reduction for latency reduction Intel Corporation
R1-167372 Views on processing time reduction and related procedures NTT DOCOMO, INC.
R1-167494 On reduced processing time for short TTI Ericsson
R1-167613 Processing time reduction for TDD with 1-slot sTTI SHARP Corporation
R1-167614 Reduced processing time for different UL and DL sTTI lengths SHARP Corporation, MTI
R1-167650 Processing time reduction and related procedures ZTE Corp, ZTE Microelectronics
R1-167657 On Processing Time Reduction for sTTI InterDigital Communications

7.2.12.3 Others

R1-166314 Link evaluation of DL data transmission under symbol--dependent impact Qualcomm Incorporated
R1-167342 Reduced timing for retransmission request HTC Corporation

7.2.13 Performance enhancements for high speed scenario

WID in RP-152263.

R1-168414 Chairman's Notes of Agenda Item 7.2.13 on Performance enhancements for high speed scenario Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed

R1-168354 PRACH enhancement in high speed scenario Huawei
Revision of R1-167171
R1-167773 PRACH for very high speed UEs Nokia, Alcatel-Lucent Shanghai Bell

R1-166315 PRACH enhancements Qualcomm Incorporated
R1-167416 Introduction of PRACH enhancement for high speed scenario Huawei

Agreements:
- Study until next meeting to down-select one of the following options:

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- Alt 1: Set 3 in R1-168354 as the new restricted set of cyclic shifts for PRACH
- Alt 2: The PRACH method described in 6.5.3.1 of RAN4 TR 36.878 for very high speed scenario is specified in 36.211

- Study further how to enable Rel 8 – 13 UEs to access the cell that supports new very high speed scenario

7.2.14 Study on Further enhancements to Coordinated Multi-Point Operation

SID in RP-160954

R1-168415 Chairman's notes of AI 7.2.14 on Study on Further enhancements to Coordinated Multi-Point Operation Ad-Hoc chair (Intel)
Contents incorporated below
Endorsed

R1-166335 TP on TR 36.741 Study on FeCoMP ZTE Corporation, Intel Corporation

Agreement:
- Endorse TP for TR36.741 in R1-166335

R1-167622 TP for TR36.741 on Section 5 ZTE Corporation, Intel Corporation
R1-167648 feCoMP Motivations and Techniques Ericsson

7.2.14.1 Remaining details of the deployment scenarios and system-level evaluation assumptions

R1-166331 Remaining details of evaluation assumptions for FeCoMP ZTE Corporation, ZTE Microelectronics
R1-167647 feCoMP evaluation assumption omissions and errata Ericsson
R1-166544 Remaining details of evaluation assumptions Intel Corporation
R1-166709 Remaining details for simulation assumptions for feCoMP Samsung
R1-167088 Simulation assumptions related to new measurements and LTE architecture IAESI, Thales, Fairspectrum
R1-166316 Remaining details of evaluation assumptions Qualcomm Incorporated

R1-168253 WF on further details of simulation assumptions for FeCoMP, ZTE Corporation, ZTE Microelectronics, Intel, ASTRI, Qualcomm, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Samsung

Agreement:
- Add the following details into the simulation assumptions:
  - Performance Metric / Parameter
    - Mean, 5%, 50%, 95% user throughput
    - Served cell throughput
    - Resource utilization (RU)
    - Packet arrival rate λ
  - Overhead
    - 3 symbols for DL CCHs, 2 CRS ports and DM-RS overhead according to number of scheduled layers
  - Antenna Polarization Model
    - Model -2 from 36.873
  - Feedback
    - PUSCH 3-2 for non-reciprocity operation (PUSCH 3-0 for reciprocity based operation)
    - CQI, PMI and RI reporting triggered per 5ms
    - Feedback delay is 5 ms
    - Other parameters can be also used
- Baseline schemes are at least below:
  - Rel-13 FD-MIMO without coordination for CS/CB
  - DPS/DPB for NCJT
  - Other option can be also used
- Support M=1 in antenna configuration only for small cell layer in evaluation of Scenario D
- Fix the reference errors proposed in R1-167647

7.2.14.2 Potential enhancements for non-coherent joint transmission

Include initial evaluation results

R1-166865 Discussion on enhancements for non-coherent JT LG Electronics
R1-167142 Discussion on non-coherent JT schemes for FeCoMP Huawei, HiSilicon
R1-166317 Enhamcements for non-coherent JT Qualcomm Incorporated
R1-166332 Initial evaluation results of non-coherent JT ZTE Corporation, ZTE Microelectronics

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R1-166333 Potential enhancements for non-coherent JT ZTE Corporation, ZTE Microelectronics
R1-166334 QCL Issues of Joint Transmission ZTE Corporation, ASTRI
R1-166462 Enhancement for non-coherent joint transmission CATT
R1-166545 CSI feedback enhancements for non coherent JT Intel Corporation
R1-166546 Control signalling enhancements for non coherent JT Intel Corporation
R1-166547 Evaluation results for non coherent JT Intel Corporation
R1-166710 Discussion on potential enhancements for non-coherent JT Samsung
R1-166711 Preliminary evaluation results for non-coherent JT for FeCoMP Samsung
R1-167143 Potential enhancements for non-coherent JT Huawei, HiSilicon
R1-167144 Initial simulation results of non-coherent JT Huawei, HiSilicon

R1-168267 WF on non-coherent JT schemes for FeCoMP, Huawei, HiSilicon, Intel, SoftBank Corp, ZTE, CATT, Qualcomm

Agreement:
- Capture the following non-coherent JT definition and classification in the TR
  - Definition: Non-coherent JT scheme corresponds to the transmission scheme where transmission of the MIMO layer(s) is performed from two or more transmission points (TPs) without adaptive precoding across the TPs.
  - Non coherent JT schemes can be classified based on the CWs transmitted from TPs:
    - **Case 1:** Different CWs are transmitted from different TPs. Each TP perform adaptive precoding independently
    - **Case 2a:** The same CW is transmitted from different TPs with spatial diversity (e.g. SFBC) coding/ spatial multiplexing.
    - **Case 2b:** The same CW is transmitted from different TPs with SFN.
  - Non coherent JT schemes can be classified based on overlapping of resource allocations from different TPs:
    - **Scheme1:** Fully overlapping scheme
      - In this scheme the resource allocations from different TPs for a UE are fully overlapped
    - **Scheme 2:** Partly overlapping scheme
      - In this scheme the resource allocations from different TPs for a UE are partly overlapped
    - **Scheme 3:** Non overlapping scheme,
      - In this scheme the resource allocations from different TPs for a UE are not overlapped

7.2.14.3 Potential enhancements for coordinated scheduling/beamforming with FD-MIMO

Include initial evaluation results

R1-166318 Enhancements for coordinated scheduling/beamforming with FD-MIMO Qualcomm Incorporated
R1-166336 Potential enhancements for CS/CB with FD-MIMO ZTE Corporation, ZTE Microelectronics
R1-166463 Coordinated beamforming with FD-MIMO CATT
R1-166548 Enhancements and evaluation of CS/CB CoMP Intel Corporation
R1-166712 Discussion on potential enhancements for CS/CB with FD-MIMO Samsung
R1-166866 Discussion on enhancements for CS/CB with FD-MIMO LG Electronics
R1-167145 Potential enhancements for CS/CB with FD-MIMO Huawei, HiSilicon
R1-167146 Initial simulation results of CS/CB with FD-MIMO Huawei, HiSilicon
R1-167649 Preliminary FeCoMP Results for Indoor Hotspot Scenario Ericsson

7.2.14.4 Others

7.2.15 Study on Enhancement of VoLTE

SID in RP-160563

R1-168416 Chairman's notes of AI 7.2.15 on Study on Enhancement of VoLTE CMCC
Contents incorporated below
Endorsed

7.2.15.1 VoLTE/video quality improvements

R1-167442 Performance evaluation of coverage enhancements for VoLTE/video quality China Telecommunications

Agreement:
Capture the following text in the reply LS to RAN2:

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1. VoLTE coverage can be effectively enhanced by relaxing the air interface delay budget. As an example, if the delay budget is extended to 100ms, about 1~3dB coverage gain can be achieved compared with 50ms delay budget for full duplex UEs. Extending maximum packet transmission time beyond 100ms can further improve the coverage. Techniques that can be used to extend the coverage if the air interface delay budget is relaxed are asynchronous UL HARQ transmission and different repetition levels in combination with RTP packet bundling.
   a) Note that the performance can be significantly impacted by the assumption of header compression.
2. The multi-subframe frequency hopping technique that was specified in CE mode A, which enables cross-subframe channel estimation, can be used to enhance the VoLTE coverage effectively.
3. The coverage for half-duplex FDD UEs is less than the coverage for full-duplex UEs. In order to maximize the VoLTE coverage that can be achieved in half-duplex FDD, opportunities to optimize the UL/DL resource utilization have been identified e.g. through techniques to reduce DL repetitions, new repetition factors, and adjusted scheduling delay.

ACTION: RAN1 respectfully asks RAN2 to take the above into account.

R1-168168 Text proposal for the RAN1 coverage enhancement for eVoLTE Sierra Wireless, Sony, AT&T
R1-168064 Text proposal for the RAN1 coverage enhancement for eVoLTE Huawei, HiSilicon

R1-166188 Overview of the eVoLTE coverage enhancement technologies Huawei, HiSilicon
R1-166319 Coverage enhancement techniques Qualcomm Incorporated
R1-166320 On eNB and UE awareness of EVS codec for coverage and mobility enhancement Qualcomm Incorporated
R1-166549 Evaluation of VoLTE support for Cat M1 UEs Intel Corporation
R1-166679 Sub-PRB Method to Improve UL Coverage, UL Capacity, and Battery Life Sierra Wireless, S.A.
R1-167103 Evaluation results of coverage enhancement schemes for eVoLTE CMCC
R1-167169 Text proposal for the RAN1 coverage enhancement for eVoLTE Huawei, HiSilicon
R1-167671 VoLTE quality improvements Ericsson
R1-167798 VoLTE Enhancements Nokia, Alcatel-Lucent Shanghai Bell

8 NR

8.1 Study on New Radio Access Technology

SID in RP-161214

R1-167373 Workplan for Study on NR Access Technology NTT DOCOMO, INC.
Decision: The document is noted.
R1-167374 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
The document (draft v0.0.4) was presented by Kazuaki Takeda from NTT DOCOMO.
Decision: The document is noted. Companies are encouraged to contact rapporteur until Wednesday.
Friday: Draft TR is revised in:
R1-168523 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
Decision: The document is endorsed as v.0.1.0 in R1-168526.

8.1.1 Forward compatibility for new radio interface

General principles to achieve forward compatibility with Phase II specification and beyond

R1-166345 NR service multiplexing requirements Qualcomm Incorporated
The document was presented by Tingfang Ji from Qualcomm and provides Qualcomm's view on forward compatibility requirements, design and timeline for difference service multiplexing scenarios:

- eMBB networks + future URLLC services
- eMBB network + future mMTC services
- WAN network + future side link services
- eMBB non-standalone (NSA) + standalone (SA)
- eMBB licensed + unlicensed
- eMBB + positioning
- Other scenarios

Discussion: Chair suggested companies using the tables as shown in this contribution and get their feedback on the different scenarios.

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Samsung → objection on NSA and SA
Decision: The document is noted. Revised in R1-168088.

R1-166868 NR operation in unlicensed spectrum LG Electronics
The document was presented by … from LGE.
- Proposal 1: With on-going work on LTE LAA for 5 GHz frequency, NR study can first focus on 60 GHz for unlicensed spectrum. For 5 GHz, it seems desirable to consider tight interworking between NR and LAA.
- Proposal 2: 120 kHz (FFS: 240 kHz) sub-carrier spacing can be considered for candidate numerologies for 60 GHz, the same as for 70 GHz.
- Proposal 3: The frame structure containing UL channel/signal in unlicensed spectrum should be designed considering channel access procedure.
- Proposal 4: For UL control design in unlicensed spectrum, consider regional regulation such as PSD, symbol duration, and multiplexing with UL sounding signal.
- Proposal 5: Consider how to transmit cell/beam identification related signals based on channel access procedure.

Decision: The document is noted.

R1-166682 Forward Compatibility of Broadcasted Signals and Channels for mMTC Sierra Wireless, S.A.
The document was presented by Serkan Dost from Sierra Wireless.
- Observation: In LTE, adding support for narrowband UEs required the duplication of many broadcasted signals/channels/info, resulting in >45% broadcasted resource usage in some cases.
- Conclusion: In LTE, it would have been advantageous if the legacy broadcasted signals/channels/info could have been decodable by narrowband UEs.
- Proposal: To avoid duplication, the NR broadcasted signals/channels/info should be decodable by both wideband and narrowband UEs
- Proposal: To optimize wideband UE performance, it shall be possible for NR broadcasted signals/channels/info to use wideband resources not decodable by narrowband UEs.

Decision: The document is noted.

R1-167119 Forward compatibility considerations on NR Integrated Access and Backhaul Qualcomm Incorporated
- Proposal 1: NR design should allow for multiple-hop self-backhauling without dictating hard limits on the hop count.
- Proposal 2: NR design should allow for topological redundant self-backhauling without confining the degree of inter-node connectivity.
- Proposal 3: NR design should allow for dynamic load balancing between backhaul links as well as between backhaul- and access links.
- Proposal 4: NR design should allow for accommodation of local changes in network topology while the remaining self-backhaul network carries traffic.

Decision: The document is noted.

R1-167235 Forward compatibility on duplexing Huawei, HiSilicon
The document was presented by Zukang Shen from Huawei.
- Proposal 1: NR should support unified duplex, fulfilling the following design targets:
  - It should allow traditional FDD operation on a paired spectrum
  - It should allow both DL and UL in either part of a paired spectrum
  - It should allow TDD operation on an unpaired spectrum where the DL/UL configuration is not dynamically changing;
  - It should allow TDD operation on an unpaired spectrum where the transmission direction of most subframes can be dynamically changing;
  - It should allow support of full duplex in the future in a forward compatible way
- Proposal 2: NR should support band-agnostic and duplex-agnostic frame structure.

Decision: The document is noted.

R1-166745 Dynamic Bandwidth Considerations for NR Samsung
The document was presented by … from Samsung.
- Observation 1: Provision of a low complexity and low cost system is necessary in order to overcome the limitations on the NR deployment that may be imposed by the requirement of a large number of RF chains to support very wide bandwidths.
- Observation 2: CA and CB can be considered to achieve freedom of spectrum usage by supporting dynamic BW configuration with CA/CB.
- Proposal: RAN1 should study a potential benefit of channel bonding scheme for unlicensed and shared spectrum in NR deployments.

Decision: The document is noted.

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R1-168059 **WF on unified duplex** **Huawei, HiSilicon, CMCC, NTT DOCOMO, CATR, Deutsche Telekom, Softbank**

The document was presented by Zukang Shen from Huawei.

- NR should support unified duplex, fulfilling the following design targets:
  - It should allow traditional FDD operation on a paired spectrum
  - It should allow different transmission directions in either part of a paired spectrum
  - It should allow TDD operation on an unpaired spectrum where the transmission direction of time resources is not dynamically changing;
  - It should allow TDD operation on an unpaired spectrum where the transmission direction of most time resources can be dynamically changing;
  - It should allow support of full duplex in a forward compatible way
  - Note: transmission directions include all of downlink, uplink, sidelink, and backhaul link

Discussion: Samsung concern with second sub-bullet and the timing for that one → make clear that it relates to forward compatibility target and not a design target without additional feasibility study (suggested LS asking RAN4 about it)
Decision: The document is noted, modified as follows:

Agreements:

- NR should support at least following design targets:
  - It should allow FDD operation on a paired spectrum
  - It should allow different transmission directions in either part of a paired spectrum
  - It should allow TDD operation on an unpaired spectrum where the transmission direction of time resources is not dynamically changing
  - It should allow TDD operation on an unpaired spectrum where the transmission direction of most time resources can be dynamically changing
  - FFS: It should allow support of full duplex in a forward compatible way
  - Note: transmission directions include all of downlink, uplink, sidelink, and backhaul link
  - Note that additional discussion is needed about the timing to support above targets, particulally the second sub-bullet
  - Note that some design targets may or may not be transparent to UE

Wednesday

R1-168106 **WF on Forward Compatibility for Broadcast Signals/Channels** **Sierra Wireless, Sony, Ericsson, Mediatek**

The document was presented by GustavVos from Sierra Wireless.

- Whether wideband and narrowband UEs can decode the same NR broadcasted signals and channels, should be considered.
  - This doesn't mean the broadcasted signals/channels need to be narrowband

Discussion: Also supported by Panasonic.
Decision: The document is noted and agreed as follows:

Agreements:

- Whether wideband and narrowband UEs can decode either all or partially the same NR broadcasted signals and channels, should be considered
  - This doesn't mean the broadcasted signals/channels need to be narrowband

Friday

R1-168132 **Way forward on the forward compatibility for NR unlicensed** **Intel, Interdigital, Ericsson, Nokia, ASB, Qualcomm, Huawei, HiSilicon, ZTE**

- At least 5 GHz and 60 GHz unlicensed bands are considered for NR unlicensed operation.
- RAN1 to start studying regulatory aspects of potential unlicensed spectrum from forward compatibility perspective.
- Note: Other unlicensed bands are not precluded for NR unlicensed operation.

Decision: The document is noted.

Not treated.

R1-166210	On forward compatibility for new radio interface	ZTE Corporation, ZTE Microelectronics
R1-166346	Forward compatibility consideration for numerology and frame structure	Qualcomm Incorporated
R1-166347	Forward compatibility consideration on service multiplexing	Qualcomm Incorporated
R1-166464	NR on-demand access for forward compatiblity	CATT
R1-166465	NR time inverval and system design for forward compatibility	CATT
R1-166550	Forward compatibility for new radio interface	Intel Corporation
R1-166608	Discussion on forward compatibility of subframe structure for NR	Guangdong OPPO Mobile Telecom.

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R1-166636 Proposals for forward compatibility NEC
R1-166648 On the aspects of waveform multiplexing requirements NEC
R1-166743 Discussion on forward compatibility for NR Samsung
R1-166744 Discussion on sync. signal considering forward compatibility aspects Samsung
R1-166867 Further considerations for forward compatibility support LG Electronics
R1-166998 Reference signal design to support bandwidth flexibility Spreadtrum Communications
R1-167123 Forward compatibility considerations for NR unlicensed operation Intel Corporation
R1-167124 Multiplexing of different numerologies for forward compatibility Intel Corporation
R1-167220 Forward compatibility consideration on symmetric design across multiple links for unified duplex Huawei, HiSilicon
R1-167327 Forward compatible control channel framework for NR INTERDIGITAL COMMUNICATIONS
R1-167541 Discussion on Supported Carrier Bandwidth for Forward Compatible NR design MediaTek Inc.
R1-167797 Baseline design for forward-compatible lean carrier in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-168088 NR service multiplexing requirements Qualcomm Incorporated

8.1.2 Waveform and multiple access schemes for new radio interface

R1-168417 Chairman's notes of AI 8.1.2 on waveform and multiple access schemes for NR Ad-Hoc chair (Qualcomm)
The document was presented by … from … and
Discussion: .
Decision: The document is noted.
Endorsed with following updates

8.1.2.1 Waveform

R1-166092 Waveform evaluation results for above 6GHz bands Huawei, HiSilicon
R1-166355 WOLA and filtered-OFDM comparison beyond link level performance Qualcomm Incorporated
R1-166487 Link Level Evaluation of Waveforms for NR AT&T GNS Belgium SPRL
R1-166494 Low PAPR Single Carrier Circularly Pulse Shaped Waveform Idaho National Laboratory
R1-166748 Evaluation results of OFDM-based waveform in DL and UL mixed numerology case (case 2 and 4) Samsung
R1-167104 Preliminary evaluations of f-OFDM and w-OFDM CMCC
R1-167376 Comparison of candidate waveforms NTT DOCOMO, INC.
R1-167529 An RX based interference mitigation method for waveform with multiple numerologies MediaTek Inc.
R1-167550 Filter delay impact of filtered OFDM on fast feedback Ericsson
R1-167595 OTFS Performance Evaluation for High Speed Use Case Cohere Technologies
R1-167794 Waveform proposal for carrier frequencies beyond 40 GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-167963 Way forward on waveform Huawei, HiSilicon, NTT DOCOMO, Nokia, ASB, Ericsson, Qualcomm, China Unicom, CATT, Samsung, CATR, Vodafone, InterDigital, LG Electronics, Softbank, Deutsche Telekom
Also supported by CT, Verizon
Agreement:

- At least up to 40 GHz for eMBB and URLLC services, NR supports CP-OFDM based waveform with Y greater than that of LTE (assuming Y=90% for LTE) for DL and UL, possibly with additional low PAPR/CM technique(s) (e.g., DFT-S-OFDM, etc.)
  - Y (%) = transmission bandwidth configuration / channel bandwidth * 100%
  - RAN1 specification will support transmission bandwidth configuration corresponding to Y up to approximately100%
  - Some evaluations in RAN1 show that Y for a NR carrier can be up to 98% of the evaluated channel bandwidths for both DL and UL without complexity and latency constraints [R1-166093]
  - Note: additional pre-processing techniques on top of CP-OFDM are not precluded, e.g., OTFS
- Additional waveforms may be supported by NR for e.g. other services (e.g. mMTC)
- It is recommended that RAN4 should target to support eNB/UE with Y significantly higher than 90% when defining the RAN4 requirements where the specification of Y should consider complexity and latency constraints
- In-band frequency multiplexing of different numerologies is supported in NR for both DL and UL, at least from the network perspective
  - It is expected that spectrum confinement on sub-band basis is specified as requirements on
    - Transmitter side in-band emission and EVM requirements
    - Reception performance in presence of other-subband interferer
    - The definition of sub-band is FFS
- From RAN1 perspective, spectral confinement technique(s) (e.g. filtering, windowing, etc.) for a waveform at the transmitter is transparent to the receiver
- Inform RAN4 the above agreements
  - RAN1 plans to perform more evaluations on waveform and will inform RAN4 with future updates, if any

R1-168422 WF on low-PAPR/CM technique Ericsson, Huawei, Panasonic, Vodafone, Qualcomm, ZTE, ZTE Microelectronics

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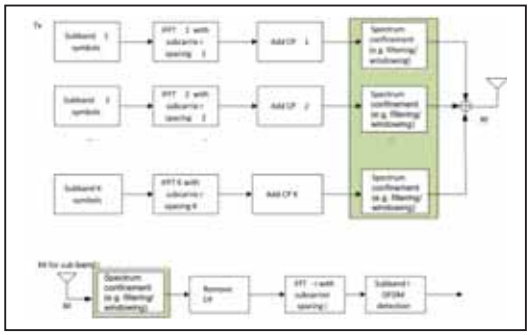
Agreements:

- At least up to 40 GHz for eMBB and URLLC services,
  - CP-OFDM without specified low-PAPR/CM technique(s) is recommended to be supported for uplink
  - For data transmission, additional low-PAPR/CM technique(s) is only considered for uplink from RAN1 specification perspective
    - Additional low-PAPR/CM technique(s) for special downlink signals such as sync signals is FFS
    - Additional low-PAPR/CM technique(s) for other uplink signals/channels is FFS
  - Additional low PAPR/CM technique(s), if specified, and CP-OFDM without specified low-PAPR/CM technique(s) for uplink are considered *as complementary to each other*

R1-168240 LS on NR waveform Huawei

Conclusion:

- The LS is agreed in R1-168258, with the following update:
- ~~For clarification, Figure 1 gives an exemplary illustration of spectrum confinement on a sub-band basis.~~



- ~~Figure 1 Illustration of spectrum confinement on a sub-band basis for downlink~~

R1-168051 WF on Low PAPR Techniques for NR Uplink Qualcomm Inc., Samsung, MediaTek, Interdigital, Idaho National Lab, IITH, CEWiT, Reliance-jio, Tejas Networks, Oppo, Vodafone, Straightpath, LG Electronics, National Taiwan University, [AT&T], Verizon Wireless, National Instrument, Spreadtrum
Also supported by ZTE, ZTE Microelectronics

Agreement:

- NR uplink should target at least the same link budget (i.e. MCL) as LTE uplink, under the same usage scenarios and similar deployment configurations (e.g., same carrier frequency)
  - Details FFS
  - Techniques can be evaluated for the uplink scenarios
    - E.g., low PAPR/CM techniques (including DFT-s-OFDM)

R1-168392 WF on Guard-Band in NR Samsung, CEWiT, IITH, Tejas Networks, Reliance-jio, MediaTek, Ericsson, Nokia, ASB, CMCC, KDDI

Agreement:

- RAN1 should continue study whether/how to support guard-band for inter-subband interfering scenarios (e.g., cases 2/3/4) with considerations of the specification/performance impact

R1-168525 Way forward on the waveform for above 40GHz Nokia, ASB, Intel, InterDigital, Mitsubishi Electric, Qualcomm, MediaTeK, Ericsson, NTU, National Instruments

Agreements:

- When considering DL and UL waveforms for spectrum band above 40GHz, RAN1 should at least consider the impact of
  - Low PA efficiency
  - Phase Noise and Doppler impairments

R1-166090 Waveform evaluation results for case 3 Huawei, HiSilicon
R1-166091 Waveform evaluation results for case 4 Huawei, HiSilicon
R1-166093 Waveform evaluation updates for case 1a and 1b Huawei, HiSilicon
R1-166119 Summary of email discussion on calibration for NR waveform Huawei, HiSilicon
R1-166120 Waveform evaluation updates for case 2 Huawei, HiSilicon
R1-166121 Summary on NR waveform evaluation results Huawei, HiSilicon
R1-166226 UW DFTsOFDM link level evaluation results below 6GHz Mitsubishi Electric
R1-166227 UW DFTsOFDM link level evaluation results above 30GHz Mitsubishi Electric
R1-166348 PA model measurements and F-OFDM/WOLA measurements Qualcomm Incorporated
R1-166349 PA model for 20-100 GHz Qualcomm Incorporated
Late submission
R1-166350 NR Spec implication for Filter/windowing OFDM Qualcomm Incorporated
R1-166351 Updated simulation assumptions for Cases 3 and 4 Qualcomm Incorporated
R1-166352 Simulation results for Cases 3 and 4 Qualcomm Incorporated

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R1-166353 Waveform proposal for > 6GHz Qualcomm Incorporated
R1-166354 OFDM and SC-FDM support for Uplink Qualcomm Incorporated
R1-166356 Simulation assumptions for OFDM and SC-FDM waveform comparison Qualcomm Incorporated
R1-166399 Tx&Rx structure of FB-OFDM ZTE
R1-166400 Simulation results of new waveform in case 1 and high speed ZTE
R1-166401 Simulation results of new waveform in case 2, 3 and 4 ZTE
R1-166594 Discussion on the window processing of FC-OFDM and WOLA ORANGE
R1-166595 FC-OFDM enhanced receiver design for very long delay spread ORANGE
R1-166650 Discussion on OFDM based waveform Sony
R1-166669 Discussion on real domain OFDM for mMTC Fujitsu
R1-166746 Discussion on multi-window OFDM for NR waveform Samsung
R1-166747 Evaluation results of OFDM-based waveform in DL and UL single numerology case (case 1a and 1b) Samsung
R1-166749 Evaluation results of OFDM-based waveform in UL single numerology and asynchronous case (case 3) Samsung
R1-166869 Waveform evaluation results in case 3 LG Electronics
R1-166870 Waveform evaluation results in case 4 LG Electronics
R1-166999 Detailed configuration of f-OFDM and W-OFDM for LLS evaluation Spreadtrum Communications
R1-167000 LLS evaluation results of NR waveforms Spreadtrum Communications
R1-167001 Link-level simulation cases for evaluating waveforms in mMTC UL with relaxed synchronization Spreadtrum Communications
R1-167029 On NR spectral confinement Ericsson
R1-167030 Mixed Numerology with PA impairment Ericsson
R1-167031 On OFDM in NR for Coverage-Limited Scenarios Ericsson
R1-167032 On OFDM in NR for Non-Coverage Limited Scenarios Ericsson
R1-167033 On resource allocation and guard subcarriers for mixed numerologies Ericsson
R1-167034 On PA impact to in mixed numerology with narrow band allocation Ericsson
R1-167035 On PA impact to in mixed numerology with wide band allocation Ericsson
R1-167036 On PAPR and CM reduction in NR Ericsson
R1-167086 GPO Based BPSK and QPSK modulation schemes with Low PAPR IITH
R1-167125 Single carrier based waveform for high frequency bands above 40 GHz Intel Corporation
R1-167126 Further discussion on GI-DFT-s-OFDM for high frequency bands above 40 GHzIntel Corporation
R1-167193 Views on multiple NR waveform proposals for high bands Intel Corporation
R1-167201 Further evaluation for NR waveforms Huawei, HiSilicon
R1-167241 Summary of email discussion on collecting information for NR waveform Huawei, HiSilicon
R1-167243 On uplink waveform below 40 GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-167244 Uplink performance results for the New Radio waveforms below 6 GHz including PA models Nokia, Alcatel-Lucent Shanghai Bell
Late submission
R1-167245 Downlink performance results for the New Radio waveforms below 6 GHz including PA models Nokia, Alcatel-Lucent Shanghai Bell
R1-167246 On independent design of Tx and Rx units for NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167337 NR waveform evaluation and proposals Panasonic Corporation
R1-167529 An RX based interference mitigation method for waveform with multiple numerologies MediaTek Inc.
R1-167530 Spectral Efficiency Evaluation for NR Uplink Waveforms Operating at High Frequency MediaTek Inc.
R1-167558 Comparison of UW DFT-s-OFDM and windowed OFDM InterDigital Communications
R1-167559 Simulation set-up for email discussion [85-17] on UW DFT-s-OFDM InterDigital Communications
R1-167560 Channel estimation and phase tracking for UW DFT-s-OFDM InterDigital Communications
R1-167593 Performance evaluation of OTFS waveform in single user scenarios Cohere Technologies
R1-167594 Performance evaluation of OTFS waveform in multiuser scenarios Cohere Technologies
R1-167604 Evaluation of OFDM with companding Qualcomm Incorporated
R1-167746 Guardband for mixed numerologies Ericsson
R1-167747 NR carrier bandwidth Ericsson
Late submission
R1-167778 Spectrum emission considerations for 5G NR waveform proposals Nokia, Alcatel-Lucent Shanghai Bell
R1-167779 On DL Rapp PA model for waveform evaluation below 6 GHzNokia, Alcatel-Lucent Shanghai Bell
R1-167791 Performance Evaluation of Cyclic-Prefix-less Precoded OFDM KDDI Corporation
R1-167795 Potential for system level gains with low PAPR waveforms Nokia, Alcatel-Lucent Shanghai Bell
R1-167796 On the RAN1 goals for waveform design Nokia, Alcatel-Lucent Shanghai Bell
R1-167808 flexi-OFDMA, a new waveform for NR CEWiT
R1-167820 Fundamentals of CPS-OFDM waveform for 5G new radio National Taiwan University
R1-167874 Evaluation results of OFDM-based waveforms in Case 1a and Case 1b National Taiwan University
Revision of R1-167821
R1-167875 Preliminary evaluation of CPS-OFDM waveform in Case 2, Case 3, and Case 4 National Taiwan University

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Revision of R1-167823
R1-167859 Generalized Root Raised Cosine (GRRC) Nyquist Filters for Filtered Modulation National Instruments Corp.

8.1.2.2 Multiple access scheme

Including remaining evaluation assumptions for multiple access scheme evaluation

R1-166094 LLS Results for UL MA schemes Huawei, HiSilicon
R1-166405 Discussion on grant free concept for UL mMTC ZTE
R1-166493 Low Latency Scheduling-based UL Access Idaho National Laboratory
R1-166551 Views on UL multiple access for NR Intel Corporation
R1-167253 On system level evaluation of multiple access schemes for mMTC and eMBB use cases Nokia, Alcatel-Lucent Shanghai Bell
R1-167554 General framework for efficient access in NR Ericsson
R1-168073 WF on UL LLS for MA Huawei, HiSilicon, CATR, CATT, Fujitsu, Spreadtrum, China Telecom, InterDigital
R1-168427 WF on UL LLS for MA Huawei, HiSilicon, CATR, CATT, Spreadtrum, Fujitsu, CMCC, InterDigital, China Telecom

Observations:

- The following non-orthogonal multiple access schemes have been reported up to RAN1#86 for at least UL NR MA (listed in the order of proposed time, i.e., increasing tdoc number)
  - Sparse code multiple access (SCMA) (e.g., R1-162153)
  - Multi-user shared access (MUSA) (e.g., R1-162226)
  - Low code rate spreading (e.g., R1-162385)
  - Frequency domain spreading (e.g., R1-162385)
  - Non-orthogonal coded multiple access (NCMA) (e.g., R1-162517)
  - Non-orthogonal multiple access (NOMA) (e.g., R1-163111)
  - Pattern division multiple access (PDMA) (e.g., R1-163383)
  - Resource spread multiple access (RSMA) (e.g., R1-163510)
  - Interleave-Grid Multiple Access (IGMA), (e.g., R1-163992)
  - Low density spreading with signature vector extension (LDS-SVE) (e.g., R1-164329)
  - Low code rate and signature based shared access (LSSA), (e.g., R1-164869)
  - Non-orthogonal coded access (NOCA), (e.g., R1-165019)
  - Interleave Division Multiple Access (IDMA), (e.g., R1-165021)
  - Repetition division multiple access (RDMA), (e.g., R1-167535)
  - Group Orthogonal Coded Access (GOCA), (e.g., R1-167535)
- Based on the contributions and the assumptions listed in Tables 1/2/3 in R1-168427, it is observed that non-orthogonal MA outperforms OFDMA in terms of UL link-level sum throughput (R1-163560) and overloading capability in the evaluated scenarios

Agreements:

- NR should target to support UL non-orthogonal multiple access, in addition to the orthogonal approach, targeting at least for mMTC

Proposal:

- In the UL LLS evaluation of non-orthogonal multiple access for mMTC, it is recommended to consider at least the following
  - MA signature (e.g., code, codebook, sequence, interleaver, etc) collision
- FFS Channel correlation between UEs
  - FFS detailed channel correlation model

Continue offline discussion

R1-168074 WF on support of UL grant-free for N Huawei, HiSilicon, China Telecom, Fujitsu, InterDigital
R1-168067 WF on Clarification of Grant-free Transmission for mMTC ZTE, ZTE Microelectronics, Qualcomm, LGE

Agreement:

- NR should target to support UL "autonomous/grant-free/contention based" at least for mMTC

Conclusion:

- In RAN1 discussion for MA, grant-free is used to represent "autonomous/grant-free/contention based"

R1-168257 WF on Clarification of Grant-free Transmission for mMTC ZTE, ZTE Microelectronics, Qualcomm, LGE, Convida, InterDigital

Agreement:

- At least the following options for "autonomous/grant-free/contention based" UL transmission should be studied
  - Opt. 1: a UE performs random resource selection
    - Details FFS
  - Opt. 2: a UE's resource is pre-configured by eNB or pre-determined
    - Details FFS
  - Other options are not precluded

R1-168075 WF on further considerations of UL grant-free for mMTC Huawei, HiSilicon, CMCC, Fujitsu

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R1-168428 WF on study of UL grant-free Huawei, HiSilicon, CATR, CATT, China Telecom, CMCC, Convida Wireless, Fujitsu, Intel, Spreadtrum, InterDigital, Oppo, Orange, ZTE, Also supported by Nokia, NTT DoCoMo

Agreements:

- Continue study at least the following:
  - Handling of potential collisions of MA signatures
  - Retransmission/repetition and potential combining, e.g. HARQ
  - Potential link adaptation, e.g. MCS/signature re-assigning
  - Relationship between grant-free and grant-based transmissions and associated UE behavior
  - Advanced receiver capabilities including complexity analysis

R1-168426 WF on definition of UL grant-free resource Huawei, HiSilicon, CATR, CATT, China Telecom, CMCC, Convida Wireless, Fujitsu, Intel, Spreadtrum, InterDigital, Oppo, Orange

R1-168423 WF on some definition of terminologies for "autonomous/grant-free/contention-based" MA LG Electronics, ETRI

R1-168325 WF on MA resource clarification ZTE, ZTE Microelectronics, Qualcomm

Agreements:

- A MA physical resource for "grant-free" UL transmission is comprised of a time-frequency block
  - Note: spatial dimension is not considered as a physical resource in this context
- A MA resource is comprised of a MA physical resource and a MA signature, where a MA signature includes at least one of the following:
  - Codebook/Codeword
  - Sequence
  - Interleaver and/or mapping pattern
  - Demodulation reference signal
  - Preamble
  - Spatial-dimension
  - Power-dimension
  - Others are not precluded
- Details on MA physical resource and MA signature resource FFS

R1-168538 WF on further clarification on grant-free transmission for mMTC LG Electronics, Huawei, HiSilicon, ETRI

Continue discussion next meeting

R1-168076 Way forward on physical layer abstraction for UL non-linear receiver Huawei, HiSilicon, CMCC, Samsung, CATT

Agreement:

- For calibration purpose ONLY:
  - For ML-type receiver, the PHY abstraction method discussed R1-168076 can be used at least for some MA schemes
    - If a different PHY abstraction method is used by a company, it has to be stated clearly and individually verified
  - Otherwise, the PHY abstraction method is up to each company
    - The PHY abstraction method is to be stated and individually verified by each company
- For evaluation purpose, PHY abstraction method is up to each company
  - A same method is used for calibration and evaluation by a given company, unless a single method can be agreed in RAN1 during evaluation phase

R1-168068 WF on UL Multiple Access Scheme Categorization for mMTC ZTE, ZTE Microelectronics, Qualcomm

R1-168069 WF on System Level Simulation Parameters for mMTC ZTE, ZTE Microelectronics, Qualcomm

R1-168326 WF on System Level Simulation Parameters for grant-free MA ZTE, ZTE Microelectronics, Qualcomm

Continue discussion next meeting especially regarding the motivation for overhead modeling and how to model the overhead

R1-168123 Way forward on non-orthogonal multiple access evaluation Samsung, Qualcomm, LGE

Revision of R1-168116

Agreement:

- For NR non-orthogonal multiple access evaluation, realistic channel estimation is prioritized and the following aspects are considered
  - The proposed DMRS pattern(s), if any, for channel estimation
    - FFS: DMRS overhead. E.g., LTE UL DMRS overhead can be used as a reference.
    - FFS: DMRS contamination due to inter-cell interference
    - FFS: Impact of DMRS collision in case of "autonomous/grant-free/contention based" multiple access
- Note: companies report the DMRS settings used for the LLS/SLS evaluation.

R1-168115 Way Forward on SLS assumptions for autonomous/grant-free/contention-based MA LG Electronics, ZTE, ZTE Microelectronics

R1-168540 WF on SLS baseline for NR MA Huawei, HiSilicon

Agreements:

- For providing absolute system level evaluation results for UL mMTC, for calibration purpose only

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- CP-OFDM as the UL waveform
  - UL DMRS overhead, 1 OFDM symbol out of 7 OFDM symbols
- A UE selects a MA physical resource randomly from a pool of orthogonal MA physical resources
  - There is no partial overlapping between the MA physical resources selected by more than one UE
  - All orthogonal MA physical resources are of same size
- Rx MMSE receiver, assuming realistic channel estimation
  - No blind decoding assumed
- Same MCS for all UEs,
  - MCS is reported by each company
- Open loop power control
  - Alpha=1, P0= -90 dBm
- Packet size is fixed by 20 bytes
- FFS other parameters, if any
  - Email discussion on any other potential parameters until 9/2 – Yi Wang (Huawei)

- Note: The above assumptions only apply to the calibration purpose, i.e. other assumptions can be used for evaluation of proposed non-orthogonal multiple access scheme(s)

R1-168541 WF on work plan for NR MA Huawei, HiSilicon

Conclusion:

- Target the following in RAN1#86bis:
  - Summary of preliminary LLS comparisons
  - Summary of preliminary SLS comparisons

R1-168551 Email discussions on NR MA Huawei, HiSilicon

- Huawei will provide the initial version of template for preliminary simulation results summary by 9th Sept, and email discussion about this template by 16th Sep (Yi, Huawei)
  - Note that SLS and LLS will have different templates
- Email discussion on SLS calibration (Yi *Huawei*) until 16th Sep.
- Email discussion on potential categorization of NR MA schemes (Yifei *ZTE*) Until RAN1 #86bis

R1-166095 Discussion on grant-free transmission Huawei, HiSilicon
R1-166096 SLS methodology for MA evaluation in mMTC scenario Huawei, HiSilicon
R1-166097 SLS Results for MA evaluation in mMTC scenario Huawei, HiSilicon
R1-166098 Discussion on the feasibility of advanced MU-detector Huawei, HiSilicon
R1-166111 On traffic model and evaluation method for mMTC evaluation Huawei, HiSilicon
R1-166357 mMTC UE battery life evaluation assumption and methodologies Qualcomm Incorporated
R1-166358 RSMA and SCMA comparison Qualcomm Incorporated
R1-166359 Resource spread multiple access Qualcomm Incorporated
R1-166402 Remaining issues on multiple access evaluation assumption ZTE
R1-166403 Grant-free multiple access schemes for mMTC ZTE
R1-166404 Receiver details and link performance for MUSA ZTE
R1-166466 Usage scenarios of non-orthogonal multiple access CATT
R1-166467 Discussion on traffic model of mMTC CATT
R1-166468 Remaining issues on evaluation assumption and methodology of MA CATT
R1-166469 Update of LLS results of PDMA CATT
R1-166470 Initial SLS results of PDMA CATT
R1-166552 On UL non-orthogonal multiple access schemes Intel Corporation
R1-166597 Ultra-Low Latency Scheduling-based UL Access Idaho National Laboratory
R1-166651 Non-orthogonal multiple access for uplink Sony
R1-166670 Further LLS results for UL non-orthogonal multiple access Fujitsu
R1-166671 DM-RS considerations for UL non-orthogonal multiple access Fujitsu
R1-166672 Filter design for filtered OFDM Fujitsu
R1-166750 Link level performance evaluation for IGMA Samsung
R1-166751 System level performance evaluation for non-orthogonal multiple access Samsung
R1-166752 Discussion on grant-free/contention-based non-orthogonal multiple access Samsung
R1-166871 NoMA scheme based on NCMA LG Electronics
R1-166872 Traffic model for evaluation of contention based MA LG Electronics
R1-166873 Discussion on Categorization of MA schemes and target scenarios LG Electronics
R1-166874 Discussion on Non-orthogonal Spreading Sequences for NoMA LG Electronics
R1-166875 Considerations on the receiver types and NoMA schemes LG Electronics
R1-166876 Performance evaluation of NCMA LG Electronics
R1-166877 Considerations on contention based MA LG Electronics
R1-167002 Performance analysis on the effect of spreading signature matrix in NR MA schemes Spreadtrum Communications
R1-167003 Multiple access schemes with considering different UE requirements Spreadtrum Communications
R1-167105 Results and Remaining Issues of LLS evaluation on Multiple Access CMCC

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R1-167206 HARQ timing relationships for grant-free transmission Huawei, HiSilicon
R1-167247 Overview of the proposed non-orthogonal MA schemes Nokia, Alcatel-Lucent Shanghai Bell
R1-167248 Contention-based non-orthogonal multiple access with frequency hopping for mMTC uplink Nokia, Alcatel-Lucent Shanghai Bell
R1-167249 Non-orthogonal coded access (NOCA) Nokia, Alcatel-Lucent Shanghai Bell
R1-167250 Receiver considerations on UL MA Nokia, Alcatel-Lucent Shanghai Bell
R1-167251 Synchronization requirement and performance analysis on UL MA Nokia, Alcatel-Lucent Shanghai Bell
R1-167252 Basic principles of Contention Based access Nokia, Alcatel-Lucent Shanghai Bell
R1-167254 Channel structure for contention based access Nokia, Alcatel-Lucent Shanghai Bell
R1-167255 Procedure design for contention based access Nokia, Alcatel-Lucent Shanghai Bell
R1-167256 Collision handling for contention based access Nokia, Alcatel-Lucent Shanghai Bell
R1-167257 Preamble transmission procedures for the mMTC uplink Nokia, Alcatel-Lucent Shanghai Bell
R1-167335 LLS Results for DL MA schemes Huawei, HiSilicon
R1-167336 SLS Results for SCMA in DL eMBB scenario Huawei, HiSilicon
R1-167339 Signature pattern generation of LSSA ETRI
R1-167340 LLS results for UL low-rate code and signature based shared access scheme ETRI
R1-167392 Discussion on multiple access for UL mMTC NTT DOCOMO, INC.
R1-167393 Discussion on multiple access for eMBB NTT DOCOMO, INC.
R1-167444 Usage scenario and physical layer design for UL non-orthogonal MA China Telecommunications
R1-167445 Classification of candidate UL non-orthogonal MA schemes China Telecommunications
R1-167517 Uplink Multiple Access for 5G mMTC Lenovo
R1-167518 Discussion on contention based UL transmission Lenovo
R1-167524 Downlink Multiple Access in NR MediaTek Inc.
R1-167535 New uplink non-orthogonal multiple access schemes for NR MediaTek Inc.
R1-167536 LLS results for RDMA,GOCA,RSMA and IDMA schemes MediaTek Inc.
R1-167537 Evaluation on SC-FDMA (NB-IoT) based multiple access scheme MediaTek Inc.
R1-167538 Evaluation on PAPR for UL multiple access schemes MediaTek Inc.
R1-167555 NR Multiple Access Ericsson
R1-167561 On the performance of IDMA and RSMA multiple access schemes InterDigital Communications
R1-167562 Further performance evaluation of UL NOMA InterDigital Communications
R1-167563 On categorization of MA schemes for NR InterDigital Communications
R1-167602 Link level simulation results of new multiple access scheme CATR
R1-167615 Multiple access schemes for NR SHARP Corporation
R1-167698 Grant-less and non-orthogonal UL transmissions in NR Intel Corporation
R1-167699 Modeling of timing offsets for UL non-orthogonal multiple access Intel Corporation
R1-167700 Link-level analysis of UL NOMA transmissions Intel Corporation
R1-167701 NR multiple access for eMBB Intel Corporation
R1-167742 Discussion on multiple access for mMTC III

8.1.3 Numerology and frame structure for new radio interface

8.1.3.1 Numerology

*Focus on the set of scale factors n in fc=15*2^n that will be supported in Phase I, whether we have symbol alignment across the scalings or not*

Tuesday

R1-168090 WF on alignment among different numerologies LG Electronics, Qualcomm

The document was presented by Yunjung Yi from LGE.

- For different numerology alignment, define the following two cases
  - Inband case: different numerologies are multiplexed in the same NR carrier
  - Outband case: different numerologies are not multiplexed in the same NR carrier
- Symbol level alignment is assumed in the following cases
  - Different subcarrier spacings with the same CP overhead in inband case
- In other cases, symbol level alignment is not assumed.
  - FFS: Slot/subframe level alignment for outband case
- For normal CP family, choose one option from the followings for symbol-level alignment
  - For $F_s = F_0 * 2^n$ (n is a positive integer, $F_0 = 15$ kHz),
    - Each symbol length (including CP) of F_0 equals the sum of the corresponding 2^n symbols of F_s
    - Option 1: The first 2^n symbols of F_s have equal symbol length
    - Option 2: Except for the first symbol of F_s, all symbols of F_s have equal symbol length. The length of first symbol of F_s is sum of length of the second symbol and 0.51 us
      - Option 2-1. 0.51us can be reserved, and all symbols have the equal length

Discussion: Intel requested looking at 6553.

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Decision: The document is noted.

R1-166553 Time interval alignment between different numerologies Intel Corporation

The document was presented by Joonyoung Cho from Intel.

- Proposal 1 (even split of 1 ms duration)
  - Duration of a time interval X for a given subcarrier spacing for cases of 15 kHz or larger is identical throughout the 1ms duration.
- Proposal 2 (single numerology for each subcarrier spacing and CP type)
  - Time interval X for a given subcarrier spacing and CP type has a single and identical numerology in all instances of the time interval X within the 1ms duration.
- Proposal 3 (1 ms boundary alignment for <15 kHz subcarrier spacing cases)
  - The start and end of a time interval X for a subcarrier spacing smaller than 15 kHz are aligned with 1 ms boundaries of 15 kHz subcarrier spacing subframes.

Decision: The document is noted.

Possible agreements:

- Symbol level alignment across the different subcarrier spacing is assumed in the case of the same CP overhead in the same subframe duration on the same NR carrier
- Extended CP is supported in NR

Continue offline discussion until Wednesday – (Qualcomm, Huawei)

Wednesday

R1-168321 Way forward on Cyclic Prefix Huawei, HiSilicon, LGE, Sony, Vodafone, Intel, CATR, CMCC Ericsson, Orange, Mediatek, Verizon, InterDigital, OPPO, CATT, China Telecom, AT&T

The document was presented by Zhenfei Tang from Huawei.

- More than one CP length should be supported for a given sub-carrier spacing
  - The different CP lengths for a given sub-carrier spacing should be of substantially different lengths.
  - For 60 kHz subcarrier spacing, at least one CP length is similar to the normal CP length of 15 kHz corresponding to LTE numerology
- Note: FFS whether all of sub-carrier spacings support more than one CP length or not
- Note: FFS whether supporting more than one CP length for a given sub-carrier spacing is mandatory or optional for a given UE

Decision: The document is noted.

R1-168338 WF on CP overhead ZTE, ZTE Microelectronics, Qualcomm

The document was presented by Thorsten Schier from ZTE.

- CP overhead should be studied, especially for the case of 60 kHz subcarrier spacing.
- NR should support solutions with the same or better performance than LTE in all channel conditions

Decision: The document is noted.

Agreements:

- NR design should allow potentially defining multiple CP lengths for a given subcarrier spacing in Phase I or later
  - Multiple CP lengths do not mean the normal CP have 2 different CP lengths in the LTE
- It should be possible to deploy NR with 60 kHz subcarrier spacing in the channel that have the same delay spread that LTE can handle with the normal CP length as one use case
  - Other subcarrier spacing solution can be considered with an equal priority in the further study
- More than one CP length should be studied for a given subcarrier spacing
  - The different CP lengths for a given subcarrier spacing can be of substantially different lengths
  - For 60 kHz subcarrier spacing, at least one CP length can be similar to the normal CP length of 15 kHz corresponding to LTE numerology
  - Other proposals are not precluded
- Note: FFS whether all of subcarrier spacings support more than one CP length or not
- Note: FFS whether supporting more than one CP length for a given subcarrier spacing is mandatory or optional for a given UE

R1-168305 WF on alignment among different numerologies LG Electronics, Intel, Ericsson, Qualcomm, Samsung, Verizon

Agreements:

- Subframe duration in ms for a reference numerology with subcarrier spacing (2^m*15)kHz is exactly $1/2^m$ ms

Working assumption:

- Alignment within a subframe

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- Symbol level alignment across different subcarrier spacings with the same CP overhead is assumed within a subframe duration in a NR carrier
- FFS: Unlicensed spectrum case

R1-168503 Way forward on slot alignment Huawei, HiSilicon, MediaTek
R1-168524 Way forward on slot alignment Huawei, HiSilicon, MediaTek
R1-168548 Way forward on slot alignment Huawei, HiSilicon, MediaTek

Agreements:

- RAN1 strives how to enable efficient time alignment between transmissions with different CP overheads

R1-167040 On scalable numerology Ericsson
R1-167394 Views on NR numerology NTT DOCOMO, INC.
R1-167527 Discussion on NR Numerology MediaTek Inc.
R1-167106 Phase Noise Measurement/Modeling and LLS for High Frequency Numerology CMCC

Agreements:

- NR numerology scalability should allow at least from [3.75 kHz] to480 kHz subcarrier spacing
- Necessity of support for less than 15 kHz subcarrier spacing (e.g., 3.75 kHz) should be studied
- Note that scalability does not mean everything should be scalable (e.g., RS density, UE/gNB processing time, signalling overhead)

The document was presented by … from … and
Discussion: .
Decision: The document is noted.

R1-166100 Evaluation on CP types for NR Huawei, HiSilicon
R1-166101 Comparison and evaluation on scaling factors for subcarrier spacing Huawei, HiSilicon
R1-166225 Considerations on numerology for support of flexible guard lengths Mitsubishi Electric
R1-166360 URLLC numerology and frame structure design Qualcomm Incorporated
R1-166363 Scaled Numerology Control Design for NR Qualcomm Incorporated
R1-166364 NR numerology scaling and alignment Qualcomm Incorporated
R1-166406 Consideration of cyclic prefix for NR ZTE
R1-166471 Discussion of NR numerology CATT
R1-166490 Numerology impact on power efficiency for mMTC ZTE
R1-166491 Considerations about symbol boundary alignment ZTE
R1-166492 Frequency multiplexing of numerologies ZTE
R1-166554 Capability to support multiple numerologies Intel Corporation
R1-166609 Subcarrier spacing design for data and reference signal Guangdong OPPO Mobile Telecom.
R1-166614 Discussion of the UE support of multiple numerologies Guangdong OPPO Mobile Telecom.
R1-166637 Discussion on numerology multiplexing NEC
R1-166652 Discussion on multiple CP types Sony
R1-166753 Discussion on symbol alignment across scaled numerology Samsung
R1-166754 Discussion on numerology support Samsung
R1-166755 Discussion on candidate subcarrier spacing values in NR Samsung
R1-166878 Discussion on alignment for different numerology multiplexing LG Electronics
R1-166879 Further evaluation results on different numerology LG Electronics
R1-166938 High speed train scenario at 30GHz: link level evaluation results for RRH and relay Mitsubishi Electric Co.
R1-166939 Numerology evaluation results for high speed scenario ETRI
R1-167004 Discussion on numerology Spreadtrum Communications
R1-167027 NR numerologies KT Corp.
R1-167040 On scalable numerology Ericsson
R1-167041 On extended CP Ericsson
R1-167106 Phase Noise Measurement/Modeling and LLS for High Frequency Numerology CMCC
R1-167107 Discussion and Evaluation on Numerology Design for High Speed Train Scenario CMCC
R1-167108 Discussion and evaluation of CP design for NR CMCC
R1-167258 On System Design for Multiple Numerologies - Initial Access Nokia, Alcatel-Lucent Shanghai Bell
R1-167259 On symbol boundary alignment in New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167260 Resource block and guard band arrangement supporting mixed numerology Nokia, Alcatel-Lucent Shanghai Bell
R1-167328 UE support for multiple numerologies with NR INTERDIGITAL COMMUNICATIONS
R1-167329 Symbol alignment across numerologies INTERDIGITAL COMMUNICATIONS
R1-167394 Views on NR numerology NTT DOCOMO, INC.

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R1-167439	Use of multiple numerologies in NR	Panasonic Corporation
R1-167527	Discussion on NR Numerology	MediaTek Inc.
R1-167528	On the alignment of OFDM symbol boundary	MediaTek Inc.
R1-167564	Impact of numerology on the non-CP based waveforms	InterDigital Communications
R1-167673	Impact of multiplexing multiple numerologies on initial access	ASUSTEK COMPUTER (SHANGHAI)
R1-167730	Study of PN Models for above 6 GHz with experimental data	National Instruments Corp.
R1-167770	CP length for NR	VODAFONE Group Plc
R1-167929	WF on RB allocation for mixed numerologies	ZTE

8.1.3.2 Frame structure

R1-166364 NR numerology scaling and alignment Qualcomm Incorporated

The document (Sections 3 and 4 only) was presented by Qualcomm.

- Proposal 2: tones of scaled numerology have center of subcarrier aligned on the grid of base numerology with wider SCS being a subset of narrower SCS in a nested manner
- Proposal 3: fixed number of tones per RB regardless of numerology
- Proposal 4: RB partition is fixed for each numerology, and schedule allocates RB based on user-specific numerology in the unit of integer number of RBs for that numerology

Decision: The document is noted.

R1-166765 Discussion on resource block size in NR Samsung

The document was presented by Young Han Nam from Samsung.

- Observations
  - NR should support much wider range of transmission bandwidth than LTE
  - Minimum payload size gives an impact on determining the PRB size and the minimum size of payload could be different depending on the potential applications and use cases to be identified.
  - Fixed time and frequency granularity approach would provide limited scalability and flexibility.
  - Scalable time and frequency granularity would sufficiently provide scalability and flexibility.
- Proposal: PRB size to be specified in NR should support scalable time/frequency granularity.

Decision: The document is noted.

R1-167338 Discussion on physical resource block for NR numerologies Panasonic Corporation

The document was presented by … from Panasonic.

- Proposal 1: The number of REs in a PRB is roughly same as LTE regardless of subcarrier spacing for eMBB and mMTC.
- Proposal 2: The number *M* of subcarriers in a PRB is same regardless of subcarrier spacing for eMBB and mMTC.
- Proposal 3: PRB boundary is aligned among numerologies. Possible guard is realized by rate matching and/or puncturing..
- Proposal 4: Centre DC subcarrier handling is same among downlink, uplink and sidelink.
- Proposal 5: PRB boundary position should not be influenced by DC subcarrier insertion. If one carrier needs to be nulled, it is realized by rate matching and/or puncturing.
- Proposal 6: Common PRB boundary position should be used regardless of the system bandwidth is odd number of PRBs or even number of PRBs.
- Proposal 7: PRB size well aligned with channel raster could be consider to simplify the RF component of UE.

Decision: The document is noted.

R1-167261 On resource block grouping and multicell coordination aspects for mixed numerology support Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by Karri Ranta-aho from Nokia.

- Observation 1: Previous results indicate performance benefits when using UE/service-specific numerology, e.g. for mixing use cases with different velocities or latency requirements.
- Proposal 1: Grouping of resources into resource block groups (RBG) with same numerology should be considered as a solution for enabling mixed numerology and a configurable air interface.
- Proposal 2: The RBG has a common absolute size in both time and frequency and it defines the minimum granularity for variable numerology within a same NR carrier bandwidth.
- Proposal 3: The size of one physical resource block (PRB) in terms of number of resource elements is common for all numerologies.
- Observation 2: Different levels of coordination of numerology among cells are possible. The need for coordination depends on the processing technique.
- Proposal 4: New Radio should provide possibilities of at least partial numerology coordination via the inter-base-station interface (the NR variant of the X2 interface).

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- Proposal 5: New Radio should provide possibilities of reference- and sounding symbol numerology alignment across multiple cells. For those reference and sounding symbols time-multiplexing with the option of full numerology alignment across different cells should be considered.

Decision: The document is noted.

R1-166941 On design of mixed numerology in a NR carrier ETRI

The document was presented by … from ETRI and investigates several issues in the NR carrier design under the mixed numerology framework.

Decision: The document is noted.

R1-166104 Discussion on time domain structures Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei.

Proposal 1: Three time domain structures should be supported for the new radio.

- DL-only time domain structure composed of a DL transmission part
- UL-only time domain structure composed of an UL transmission part
- Mixed DL and UL time domain structure composed of a DL transmission part (located at the beginning), a guard and an UL transmission part (located at the end)
  - DL-dominant: a DL transmission part (mainly for data assignments and data), a guard, a configurable short UL transmission part (mainly for UCI and SRS).
  - UL-dominant: a configurable short DL transmission part (mainly for data assignments), a guard, a UL transmission part (mainly for data, UCI and SRS)

Proposal 2: NR should support both dynamic TDD operation and semi-static TDD operation.

- Candidate TDD UL/DL configurations could be defined in NR for semi-static TDD operation. FFS the detailed candidate TDD UL/DL configurations.
- The "direction" (uplink or downlink) of a subframe can change on subframe basis for dynamic TDD operation. FFS the indication of the "direction" of a subframe.

Proposal 3: The basic length of a time domain structure is equal to the subframe durartion, which is defined from a basic time unit of 1 ms corresponding to a basic subcarrier spacing f_0 with a given number of OFDM symbols for a given CP length, and the subframe duration scales with subcarrier spacing.

- Shorter subframe durations with 0.5ms, 0.25ms and 0.125ms are supported with the subcarrier spacing increasing.
- Longer subframe duration with the subcarrier spacing decreasing is FFS.

Proposal 4: A first DL control channel located at the front of each time interval of a basic length (i.e. subframe) of a time domain structure should be supported in NR. A second DL control channel embedded in the data region in DL subframe or DL-dominant structure can also be considered for NR.

Proposal 5: The reference signals used for demodulating a control channel or a data channel are contained only within the same time/frequency resource for that channel, and are transmitted only when that channel is present.

Decision: The document is noted.

R1-166365 Advanced frame structure Qualcomm Incorporated

The document was presented by … from Qualcomm.

- Observation 1. Advanced frame structures should allow for low priority links to yield to higher priority links to enable dynamic and decentralized UL-DL switching.
- Observation 2. Advanced frame structures should allow some gaps for sensing to enable control interval transmission on unlicensed spectrum.
- Observation 3. Advanced frame structures should allow for UE's to establish sidelink and exchange traffic while managing interference. This may apply to both broadcast and unicast sidelink transmissions.

Decision: The document is noted.

R1-166664 Frame Structure Design for NR Sony

The document was presented by Martin Beale from Sony.

- Proposal 1: RAN1 agree on (1) basic atomic building blocks of NR and (2) the time to process the building blocks.
- Proposal 2: During the NR study phase, RAN1 create some reference physical structures that are used for the purposes of evaluation.
- Proposal 3: Combinations of building blocks that span an Interval-X should be signaled semi-statically.
- Proposal 4: The DL transmission part, guard and UL transmission part can exist in any order within an Interval-X.
- Proposal 5: Within an Interval-X, there can be a guard region after the uplink transmission region.
- Proposal 6: RAN1 evaluates UE timing constraints before defining bidirectional self-contained TDD physical structures (Interval-X).
- Proposal 7: The basic physical structure of NR should allow the creation of NR subframes of a length that is either an integer multiple of the LTE subframe length or a common divisor of the LTE subframe length.

Decision: The document is noted.

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R1-167946 Outcome of off line discussion NTT DOCOMO, Inc.

The document was presented by Fred Takeda from NTT DOCOMO.

- A subframe duration is defined by *x* OFDM symbols for a given CP overhead.
  - *x* is the same for all subcarrier spacing values.
  - This does not preclude multiple scheduling occasions within a subframe duration.
  - This does not preclude that one scheduling occurs over multiple subframe durations.
- A UE assumes at least one reference numerology in a given NR carrier which defines subframe duration.
- Specification supports multiplexing numerologies in TDM and/or FDM within/across (a) subframe duration(s).

Decision: The document is noted, modified as follows:

Agreements:

- A subframe duration is defined by the duration of *x* OFDM symbols given a reference numerology
  - With the same CP overhead, a single value of *x* is specified irrespective of the subcarrier spacing value chosen for the reference numerology
  - This does not preclude multiple data transmission opportunities in time within a subframe duration
  - This does not preclude multiple control transmission opportunities in time for both DL and UL within the subframe duration
  - This does not preclude one data transmission to span over multiple subframe durations
- A UE has one reference numerology in a given NR carrier which defines subframe duration for the given NR carrier
  - FFS: In a given NR carrier, whether different UEs may have different reference numerologies or may not
- Specification supports multiplexing numerologies in TDM and/or FDM within/across (a) subframe duration(s) from a UE perspective

Agreement:

- PRB definition where the number of subcarriers per PRB is the same for all numerologies is supported
  - Examples of the number of subcarriers per PRB for NR study are 12, ~~10~~, 16
  - Additional PRB definition with the different number of subcarriers is not precluded

Agreement:

- For subcarrier spacing of 2^n * 15kHz, subcarriers are mapped on the subset/superset of those for subcarrier spacing of 15kHz in a nested manner in the frequency domain

Agreement: The number of subcarriers per PRB for NR study are 12, 16

Conclusion: RAN1 will down select the number of subcarriers per PRB in the next meeting

R1-167956 Way Forward on RB allocation for mixed numerologies ZTE, ZTE Microelectronics, Ericsson, Qualcomm

The document was presented by Patrick Svedman from ZTE.

- Subcarriers from scaled numerologies are aligned such that their center frequencies coincide
- RBs for different numerologies have a fixed grid
- Resources are allocated in integer numbers of resource blocks (RBs)
- For numerologies that are derived by sub-carrier spacing scaling from the same basic numerology, their RB grids are allocated according to the enclosed figure

Decision: The document is noted. Continue offline discussion until Tuesday

Tuesday: Revised in

R1-167978 Way Forward on RB allocation for mixed numerologies ZTE, ZTE Microelectronics, Ericsson, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell

- For one NR carrier
  - Each numerology has a fixed RB grid
  - Resources are allocated in integer numbers of resource blocks (RBs).
  - For subcarrier spacing of 2^n * 15kHz, RBs are mapped on the subset/superset of RBs for subcarrier spacing of 15kHz in a nested manner in the frequency domain

Decision: The document is noted. Further revised in:

R1-168140 Way Forward on RB allocation for mixed numerologies ZTE, ZTE Microelectronics, Ericsson, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic

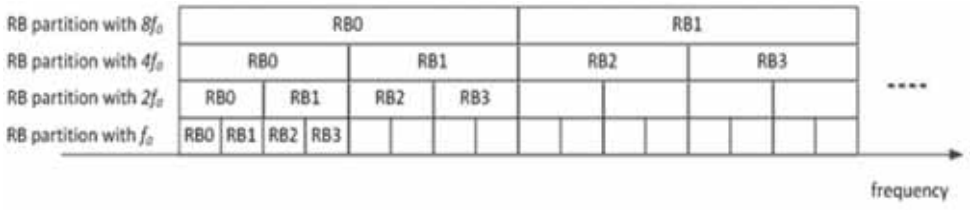
Decision: The document is noted

Agreements:

- In one carrier when multiple numerologies are time domain multiplexed,
  - RBs for different numerologies are located on a fixed grid relative to each other
  - For subcarrier spacing of 2^n * 15kHz, the RB grids are defined as the subset/superset of the RB grid for subcarrier spacing of 15kHz in a nested manner in the frequency domain

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- Note that following numbering in the figure is just an example
- FFS: frequency domain multiplexing case



Continue offline discussion until Wednesday – Thorsten (ZTE)

R1-168309 Way Forward on RB grid definition for mixed numerologies ZTE, ZTE Microelectronics, Ericsson, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, Panasonic, Convida Wireless

Conclusions: Proponents are encouraged to study followings

- Alt. 1: Adopt RB grid for FDM as it is agreed in TDM
- Alt. 2: Use RB grid corresponding to the reference numerology for FDM, applied the same grid to TDM, and revisit above agreements for TDM

Possible agreements:

- No explicit DC subcarrier reserved
- DL and UL have the same DC subcarrier handling

Continue offline discussion until Tuesday

Tuesday Agreement: No explicit DC subcarrier is reserved both for DL and UL

R1-166362 **Self-contained subframe timeline analysis Qualcomm Incorporated**

The document was presented by Jing Jiang from Qualcomm.

- Observation 1: A fundamental sustainability threshold for UE modem processing throughput on the downlink is one symbol processed per symbol time.
- Observation 2: In a self-contained DL subframe, the amount of gap between the end of the data channel to the beginning of ACK/NACK heavily impacts modem processing pipeline architecture and the hardware capability requirement.
- Observation 3: Even with symbol-by-symbol processing, the pipeline depth may span more than one symbol time. This in turn imposes a requirement for the amount of gap. Reducing the payload towards the end of the data channel is an effective way to decouple pipeline design and the amount of gap required.
- Proposal 1: UE capability framework should be designed to be flexible to facilitate hardware-efficient support for self-contained subframe.
- Observation 4: Scaled numerology facilitates better pipelined processing and offers significant timeline advantage, which is especially crucial for self-contained UL centric subframe.
- Proposal 2: Scaled numerology for the downlink control channel should be studied with applicability for uplink-centric and downlink centric self-contained subframe types.
- Observation 5: Symbol-by-symbol construction and transmission of uplink data is crucial for reducing the latency in UE responses.
- Proposal 3: Uplink reference signal and data channel should be designed to facilitate symbol-by-symbol processing on the UE. This study should extend up the protocol stack to ensure there is no roadblock and to identify potential cross-layer optimizations.
- Proposal 4: UL burst channel structure should be designed with considerations for processing timeline to feedback ACK/NACK.
- Observation 6: Self-contained subframe operation may be feasible with gaps on the order of ~1 OFDM symbol, and equivalently with X and Y on the order of 10s of us.
- Proposal 5: Downlink control and data channels should be designed with flexibility to support single-interlace transmission to allow time-critical processing on the eNB side for immediate ACK processing and potential retransmission.

Decision: The document is noted.

R1-167523 **Timing Relationship for NR Frame Structure MediaTek Inc.**

The document was presented by Peikai Liao from MediaTek.

- Proposal 1: For eMBB, the time separation, X, between the end of the DL data transmission and the beginning of corresponding acknowledgement reporting should be ≥ 160μs.
- Proposal 2: For eMBB, the time separation, Y, between the end of UL grant transmission and the beginning of the corresponding uplink data transmission should be ≥ 160μs.
- Proposal 3: For eMBB, the following timing relationship should be the baseline.

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  - Timing relationship between DL data reception and its corresponding acknowledgement in UL: Subframe N→N+2+K or N+4+K, where K is signalled to a UE dynamically and/or semi-statically; FFS K values
  - Timing relationship between UL assignment and its corresponding UL data transmission: Subframe N→N+2+K or N+4+K, where K is signalled in DCI; FFS K values
  - Timing relationship between DL scheduler and its corresponding DL data: Subframe N→N
- Proposal 4: For URLLC, further evaluate whether self-contained operation is necessary.
- Proposal 5: For self-contained operation, DL physical data channel structure should enable on-the-fly decoding with the following design considerations.
  - Demodulation pilots for the physical DL control channel should be located at the beginning of the physical DL control channel.
  - Decoding complexity of physical DL control channel should be reduced with high reliability, compared to LTE.
  - Demodulation pilots for the physical DL data channel should be located at the beginning of the physical DL data channel but other additional demodulation pilots at later location are not precluded.
  - Demodulation pilots for the physical UL data channel should be located at the beginning of the physical UL data channel but other additional demodulation pilots at later location are not precluded.
  - Coded bit to RE mapping should be frequency first and then time in DL data channel.
  - Code block size for DL data should be equal to or less than 3000 bits.
- Proposal 6: For self-contained operation, UL physical data channel structure should enable on-the-fly encoding with the following additional design considerations.
  - Demodulation pilots for the physical UL data channel should be located at the beginning of the physical UL data channel but other additional demodulation pilots at later location are not precluded.
  - Coded bit to RE mapping should be frequency first and then time in UL data channel.
  - Code block size for UL data should be equal to or less than 3000 bits.

Decision: The document is noted.

R1-167299 Timing requirements and scenarios for 5G NR Hybrid ARQ Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by Karri Ranta-aho from Nokia.

- Observation 1: The timing of ACK/NACK's and the number of SAW channels shall be configurable to efficiently support for different network implementations (e.g. to account for L1-L2 latencies for C-RAN implementations). The range of timing values from uplink data transmission until reception of the corresponding ACK/NACK by the UE should be configurable to equal values of sub-ms up to values of ~6 ms.
- Observation 2: The HARQ scheme shall support asymmetric link operation, where the transmission time interval (TTI) and/or time of ACK/NACK transmissions can be configured differently for the uplink and downlink per UE.
- Observation 3: For URLLC, various HARQ enhancements such options for early ACK/NACK feedback, automatic retransmissions until reception of ACK, and potential joint UL/DL HARQ design shall be supported.
- Observation 4: For mMTC use cases, options for simplified HARQ operation are desirable, including support for low cost mMTC devices with half-duplex capabilities and relaxed timing requirements.
- Observation 5: The minimum supported timing relationship between DL data reception and the corresponding UL ACK/NACK transmission, as well as the minimum ttiming relationship between the UE receiving an UL scheduling assignment and corresponding UL data transmission, could be UE category dependent.
- Proposal 1: The following timing relationships shall be flexibly configurable per UE; (i) timing relationship between DL data reception and corresponding ACK/NACK, (ii) time-duration of the ACK/NACK transmission, and (iii) timing relationship between the UL assignment and corresponding UL data transmission. Configured per UE, using either dedicated RRC-, MAC-, or PHY-level control signalling,
- Proposal 2: It shall be studied if there are attractive complexity and cost tradeoffs from having UE categories with different minimum timing relationships for DL data reception and the corresponding UL ACK/NACK transmission, and between the UE receiving an UL scheduling assignment and corresponding UL data transmission.

Decision: The document is noted.

Observations:

- At least followings are potentially identified as mean to realize the short processing delay and RAN1 will continue to study it
  - Frequency-first and time-second mapping
  - Code block segmentation that facilitates symbol-by-symbol processing
  - Reduce symbol durations
  - DL assignment and UL grant before and/or at the beginning of its scheduled data duration
  - TBS restriction
  - Timing advanced restriction
  - Channel coding
  - Front loaded RS mapping for control channel
  - Grant free transmission

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Agreements:

- Unless otherwise specified or indicated to the UE, the UE shall make no assumption on whether to transmit or to receive at least within the data region(s) in a given time interval X
  - Indication to the UE may include
    - Dynamic L1 signaling
    - RRC configuration
    - Broadcast signaling
    - …

Agreements:

- The following is supported for NR
  - From UE perspective, HARQ ACK/NACK feedback for multiple DL transmissions in time can be transmitted in one UL data/control region is supported
  - Some or all of the following timing relationships can be indicated to a UE dynamically by the L1 DL signaling (FFS: explicit or implicit)
    - Timing relationship between DL data reception and corresponding acknowledgement
    - Timing relationship between UL assignment and corresponding UL data transmission
    - Note: Default value, if any, for each timing relationship is FFS (agreement from RAN1 #85)
    - Note: Potential values for each timing relationship has to be studied further considering e.g., UE processing capability, gap overhead, UL coverage, and etc. (agreement from RAN1 #85)
    - Note: Other means of indicating the timing relationship are not precluded
  - Some or all of the following timing relationships can be indicated to a UE semi-statically (FFS: explicit or implicit)
    - Timing relationship between DL data reception and corresponding acknowledgement
    - Timing relationship between UL assignment and corresponding UL data transmission
    - Note: Default value, if any, for each timing relationship is FFS (agreement from RAN1 #85)
    - Note: Potential values for each timing relationship has to be studied further considering e.g., UE processing capability, gap overhead, UL coverage, and etc. (agreement from RAN1 #85)
    - Note: Other means of indicating the timing relationship are not precluded

Possible agreements:

- NR design at least supports the following
  - Fixed default timing relationship between DL assignment and corresponding DL data transmission
  - FFS: Additionally, a UE is indicated dynamically and/or semi-statically on timing relationship between DL assignment and corresponding DL data reception
    - Note: This additional signalling can overrides the fixed default timing
  - FFS: A UE is indicated dynamically and/or semi-statically on the duration for DL data reception and UL data transmission

Continue offline discussion within Wednesday – (LGE)

Wednesday

R1-168304 WF on Data Scheduling LG Electronics, Qualcomm

The document was presented by Yunjung Yi from LGE.

- NR design supports the following
  - A UE is indicated dynamically and/or semi-statically on timing relationship between DL assignment and corresponding DL data reception
  - FFS whether there is a fixed timing relationship between DL assignment and corresponding DL data transmission
  - A UE is indicated dynamically and/or semi-statically on the duration for DL data reception and UL data transmission

Decision: The document is noted.

R1-168290 WF on Legacy UEs Blank Resource Indication Qualcomm Incorporated, Samsung, Ericsson

The document was presented by Tingfang Ji from Qualcomm.

- Proposal 1: Study signalling describing blank resources in time- and/or frequency-domains in each "slot".
- Proposal 2: Consider broadcast and unicast signalling options
  - Unicast signalling could be in the DCI for scheduled legacy UEs to implicitly describe blank resources
  - Broadcast signalling could be used for scheduled and non-scheduled UEs

Decision: The document is noted.

Continue offline discussion until Thursday – Yunjung (LGE), Tingfang (Qualcomm)

R1-168434 WF on Resources for data scheduling LG Electronics, Qualcomm
R1-168502 WF on Resources for data scheduling LG Electronics, Qualcomm

Conclusions: Further study

- how to multiplex mini slot and slot

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- the benefit and mechanism of indicating blank resources at least for forward compatibility perspective

R1-168058 Way Forward on Slot Types Huawei, HiSilicon, Docomo, Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by David Mazzarese from Huawei.

- Basic slot types are shown in enclosed figure (seen from the network)
  - Basic slot type is defined by the number of (*N*) OFDM symbols using the same numerology
    - *N*=7 for normal CP, *N*=6 for extended CP
    - This means there can be 0, 1 or 2 DL/UL switching points within 1 ms at 15 kHz subcarrier spacing, depending on network choice
  - Shorter slots are obtained with larger subcarrier spacing
- Additional slot types are not precluded

Decision: The document is noted.

R1-167441 Comparison of time domain frame structure Panasonic Corporation

The document was presented by Hidetoshi Suzuki from Panasonic.

- Proposal: For 15 kHz subcarrier spacing of self-contained allocation with sufficient DL or UL data length cases, 2 HARQ process within 1ms and 1 DL to UL switching point should be used. In the other cases, 1 HARQ process within 1ms and 0 or 1 DL to UL switching period should be used.

Decision: The document is noted.

R1-168108 WF on time-domain structure in NR LGE, Panasonic

The document was presented by Yunjung Yi from LGE.

- Within a subframe of x OFDM symbols, at least the following are supported
  - DL portion
    - DL portion size can be from 0 to 14 symbols from the start of the subframe
  - UL portion
    - UL portion size can be from 0 to 14 symbols
    - The time-location of UL portion within a subframe can be flexible
- x = 14 with 15 kHz normal CP

Decision: The document is noted.

Possible agreements:

- Within a time transmission duration of y OFDM symbols, at least the following are supported
  - DL portion
    - DL portion size can be from 0 to y time transmission duration from the start of the time transmission duration
    - At least 0 and y are supported
  - UL portion
    - UL portion size can be from 0 to y time transmission durations
    - At least 0 and y are supported
    - The time-location of UL portion within a time transmission duration can be flexible
  - DL/UL portion is contiguous

Possible agreement:

- x = 14 with 15 kHz normal CP

Continue offline discussion within Tuesday – (Panasonic)

R1-168154 WF on time-domain structure in NR Panasonic

The document was presented by Hidetoshi Suzuki from Panasonic.

Decision: The document is noted and:

Possible agreements:

- In case of the same numerology between DL and UL, within a time duration of y OFDM symbols, the following are supported
  - DL portion
    - DL portion size can be from 0 to y symbol time duration from the start of the time duration
    - At least 0 and y are supported
  - UL portion
    - UL portion size can be from 0 to y symbol time duration
    - At least 0 and y are supported
    - The time-location of UL portion within a time transmission duration can be flexible
  - y symbols are contiguous
- FFS: Start from UL portion case
- At least following is supported.

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  - y = 14 in 15 kHz subcarrier spacing in normal CP
  - FFS: y= 7 with 15 kHz subcarrier spacing in normal CP
- FFS: a time duration y is same as a subframe duration or multiple time duration present in a subframe duration.
- FFS: different numerology between DL and UL

Continue offline discussion within Tuesday – (Panasonic)

Wednesday

R1-168167 WF on time-domain structure in NR Panasonic, LGE

Decision: The document (update of R1-168154) is noted. Further revised in:

R1-168341 WF on time-domain structure in NR Panasonic

Decision: The document is noted.

Possible agreements:

- In case of the same numerology between DL and UL, within a time duration of y OFDM symbols, the following are supported
  - DL portion
    - DL portion size can be from 0 to y symbol time duration from the start of the time duration
    - At least 0, y, one value within the range (0,y) are supported
    - Within a DL portion, one or multiple mini slots can be available.
  - UL portion
    - UL portion size can be from 0 to y symbol time duration
    - At least 0, y, one value within the range (0,y) are supported
    - The time-location of UL portion within a time transmission duration can be flexible
    - Within a UL portion, one or multiple mini slots can be available.
  - Each of DL portion and UL portion is contiguous.
  - The spec should allow DL portion and UL portion is TDMed with a gap (in case of non-full duplex)
- At least following is supported.
  - y = 14 in 15 kHz subcarrier spacing in normal CP
  - FFS: y= 7 with 15 kHz subcarrier spacing in normal CP
- FFS: The time duration y is the same as the subframe duration and/or a multiple of the time durations present in the subframe duration.
- FFS: different numerology between DL and UL
- FFS: time duration of y starts from UL
- FFS: whether and how to extend the discussion on DL portion/UL portion length required for the coexistence with LTE TDD

Continue offline discussion until Thursday – Suzuki (Panasonic)

R1-168368 WF on time-domain structure in NR Panasonic

Agreements:

- A slot can contain all downlink, all uplink, or {at least one downlink part and at least one uplink part}
  - FFS regarding the number of switching points, multiplexing of different use cases (e.g., multiplexing eMBB and URLLC use cases) and/or numerologies in the time domain

R1-168469 WF on slot and time interval X Huawei, HiSilicon, Sharp, Panasonic

R1-168294 WF on Frame Structure Ericsson, Huawei, Qualcomm, Nokia, Sony, DoCoMo, MediaTek, Fujitsu, CATT, Intel, ZTE, InterDigital

The document was presented by Stefan Parkvall from Ericsson.

- Subframe
  - Already agreed upon
  - Assume x=14 in the reference numerology for subframe definition (for normal CP)
  - FFS: y=x and/or y=x/2
- Slot
  - Slot of duration y OFDM symbols in the numerology used for transmission
  - An integer number of slots fit within one subframe duration (at least for transmission numerologies shorter than or equal the reference numerology)
  - The structure allows for ctrl at the beginning
  - The structure allows for ctrl at the end
  - The structure allows for ctrl at the end and at the beginning
  - One possible scheduling unit
- Mini-slot
  - Should at least support transmission shorter than y OFDM symbols in the numerology used for transmission
  - May contain ctrl at the beginning and/or ctrl at the end
  - The smallest mini-slot is the smallest possible scheduling unit (FFS: smallest number of symbols)

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› Note: the names are for the purpose of discussion. Whether some terms can be merged or not is FFS

Decision: The document is noted and modified as follows:

Agreements:

- Followings are considered as starting points of NR frame structure at least within the CP overhead
  - Subframe
    - Already agreed upon
    - Assume x=14 in the reference numerology for subframe definition (for normal CP)
    - FFS: y=x and/or y=x/2 and/or y is signalled
  - Slot
    - Slot of duration y OFDM symbols in the numerology used for transmission
    - An integer number of slots fit within one subframe duration (at least for subcarrier spacing is larger than or equal the reference numerology)
    - The structure allows for ctrl at the beginning only
    - The structure allows for ctrl at the end only
    - The structure allows for ctrl at the end and at the beginning
    - Other structure is not precluded
    - One possible scheduling unit
  - Mini-slot
    - Should at least support transmission shorter than y OFDM symbols in the numerology used for transmission
    - May contain ctrl at the beginning and/or ctrl at the end
    - The smallest mini-slot is the smallest possible scheduling unit (FFS: smallest number of symbols)
  - Note: the names are for the purpose of discussion. Whether some terms can be merged or not is FFS
  - FFS whether NR frame structure needs to support both slot and mini-slot or these can be merged

R1-168191 WF on different time intervals for NR frame structure ZTE, ZTE Microelectronics, Qualcomm

- For a reference numerology, multiple durations are defined in number OFDM symbols for time interval
  - A minimum duration is defined in x1 OFDM symbols
- At least from network perspectives, different durations of time intervals can be multiplexed in TDM and/or FDM
  - FFS: Whether or not NR support nested time interval structure for different duration.
  - Resources already allocated for a longer time interval may also be used for a shorter time interval
    - E.g. for URLLC operation

Decision: The document is noted. Further revised in:

R1-168331 WF on different time intervals for NR frame structure ZTE, ZTE Microelectronics, Qualcomm, Sharp, InterDigital

Discussion: .Also supported by MTI

Decision: The document is noted.

Possible agreements:

- At least for DL, it should be possible to override the ongoing transmission with a short transmission at least from NW perspective

Possible agreements:

- For a reference numerology, multiple durations are defined in number OFDM symbols for time interval
  - A minimum duration is defined in x_1 OFDM symbols

Possible agreements:

- At least from network perspectives, different durations of time interval can be multiplexed in TDM and/or FDM
  - FFS: Whether or not NR supports nested time interval structure for different duration
- Resources already scheduled for a longer time interval may be rescheduled for a shorter time interval , e.g. for URLLC operation
  - Option1: Ongoing transmission for longer interval is punctured
  - Option2: Ongoing transmission for longer interval is dropped
  - Other solutions are not precluded

Continue offline discussion until Thursday – Zhisong (ZTE)

R1-168438 WF on Supporting URLLC in NR LG Electronics, ZTE

R1-168499 WF on different time intervals for NR frame structure ZTE, ZTE Microelectronics, Qualcomm, LGE Sharp, MTI, InterDigital, CATT

R1-168545 WF on Supporting URLLC in NR LG Electronics, ZTE, Sharp, MTI,

R1-168550 WF on Supporting URLLC in NR LG Electronics, ZTE, Sharp, MTI,

Agreements:

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- At least the following potential options should be considered
  - At least for shorter transmission UL, semi-static resource sharing between URLLC and eMBB
    - FDM and/or TDM manner
      - UL grant-free transmission for URLLC
      - Other schemes are not precluded
  - Dynamic resource sharing between URLLC and eMBB
    - For DL, mechanisms to schedule a transmission where the resources of it can overlap with resources of ongoing/scheduled longer transmission at least from network perspective
      - FFS: A similar or same mechanism applicability to UL
      - Preemption or superposition
      - Other schemes are not precluded
    - Scheduling based approaches (e.g., by adapting transmission duration or by using different subbands) to allow multiplexing of different durations of transmission
    - UL grant-free transmission for URLLC
    - Other schemes are not precluded
  - Other mechanisms are not precluded

R1-166488 Wireless backhaul/relay for NR AT&T GNS Belgium SPRL
Decision: The document is noted.
R1-166368 UE Power Consideration based on Days-of-Use Qualcomm Incorporated
Decision: The document is noted.
R1-168352 WF on NR UE Power Consumption Reduction Qualcomm
Agreements:

- Impact of UE DL reception energy consumption should be studied also considering the total power consumption mainly focusing on DoU
  - e.g., UE decoding power consumption in the physical layer DL control blind decoding in lack of grant
  - e.g., UE decoding power consumption in the slot with the data
  - e.g., UE decoding power consumption in the data reception process
  - e.g., UE decoding power consumption in the measurement
  - e.g., UE decoding power consumption in the SS
- UE power reduction techniques also should be studied

R1-168430 WF on number of HARQ processes for NR Qualcomm, DCM, ZTE~~, Verizon~~
R1-168342 Way Forward on HARQ Process for NR MediaTek, Intel, Samsung, Nokia, ASB

R1-168532 Way Forward on HARQ Process for NR Mediatek

R1-168395 WF on DL and UL transmission for NR CMCC, China Telecom, China Unicom, Softbank, CATT, Huawei, HiSilicon, OPPO, Nokia, Alcatel-Lucent Shanghai Bell, MediaTek, Qualcomm, Samsung, ZTE, ZTE Microelectronics, LG Electronics, CATR
Also supported by Ericsson, Convida, Xiaomi
Agreements:

- NR supports at least semi-statically assigned DL/UL transmission direction as gNB operation
  - The assigned DL/UL transmission direction can be signalled to UE by higher layer signalling

R1-168347 WF on additional RS for NR LG Electronics, Samsung, NTT DOCOMO
Agreements:

- In addition to the front-loaded RS agreed to study in RAN1#85, same or extended/additional RS is studied in NR of at least the following:
  - Estimate/compensate Doppler parameters
  - Compensate phase rotation and frequency offset
  - Note that RS may or may not be UE-specific

R1-168489 Use Cases/Scenarios for Slot Structure Discussion Qualcomm

R1-168531 WF on Use Case Discussion for Time Domain Structure Use Cases Qualcomm

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- Email discussion where proponents provide further input on use cases with completion by Sep 15th – Joseph (Qualcomm); e.g.,
  - What specific cases to support the particular numerologies such as 15 kHz subcarrier spacing
  - How often can DL control appear? UL control?
    - How is this associated with the transmission duration mentioned in R1-168489?
  - How often can user be scheduled?
    - What is smallest possible scheduled duration?
  - How often may gaps appear w/in transmission duration? How much overhead?
  - Note: please provide all lengths in terms of symbols for each intended SCS.
    - SCS as provided (or updated from) R1-168489 "Use Cases/Scenarios for Slot Structure Discussion"
    - Absolute times (e.g, ms or us) should also be supplied for clarification
    - Any other questions may be added

R1-168534 Way forward on time-domain structure NTT DOCOMO

R1-168491 Way forward on control channel for NR LG Electronics, Samsung, Panasonic
R1-168429 WF on Integrated Backhaul and Access Huawei, HiSilicon, AT&T, Samsung, Qualcomm, Ericsson, ASTRI

Conclusions:

- Mechanisms for joint operation of backhaul link and access link should be studied by NR, including
  - Study dynamic resource allocation among backhaul and access links, including TDM and FDM and SDM approaches under half-duplex constraint
  - Study multi-hop backhauling and multi-site connectivity in backhauling
  - Mechanism for integration of new TRPs/RNs carrying integrated backhaul and access functionalities
  - Mechanisms for discovery and management of backhaul links for the connected TRP/relay nodes (if supported) with integrated backhaul and access links
  - Other aspects/functionalities such as forward compatibility to study full duplex operation on backhaul and/or access links are FFS
- RAN1 should strive for a common mobility handling and beam management framework for mobile TRP/relay nodes (if supported) carrying joint operation of backhaul and access functionalities and the usual UEs
- Note: No assumption on particular RAN architecture

The document was presented by … from …
Discussion: .
Decision: The document is noted.

R1-166102 Overview of frame structure for NR Huawei, HiSilicon
R1-166103 Discussion on flexible frame structure with different numerologies Huawei, HiSilicon
R1-166105 Discussion on timing relations for NR frame structure Huawei, HiSilicon
R1-166106 Support of flexible bandwidth Huawei, HiSilicon
R1-166117 Wideband support for NR Huawei, HiSilicon
R1-166122 Evaluation parameters for unified duplex study Huawei, HiSilicon
R1-166361 Control interval and scheduling interval Qualcomm Incorporated
R1-166367 Multi-TTI frame structure and utility for short subframes in MMW Qualcomm Incorporated
R1-166368 UE Power Consideration based on Days-of-Use Qualcomm Incorporated
R1-166407 Uplink data scheduling and transmission for NR frame structure ZTE
R1-166408 Multiplexing of eMBB and URLLC ZTE
R1-166409 UL part in NR Frame structure for the unlicensed spectrum ZTE
R1-166410 Consideration on URLLC in NR frame structure ZTE
R1-166472 NR frame structure design CATT
R1-166488 Wireless backhaul/relay for NR AT&T GNS Belgium SPRL
R1-166555 Frame structure design for NR Intel Corporation
R1-166556 Requirements and solutions for LTE/NR Coexistence Intel Corporation
R1-166610 On DL HARQ for NR Guangdong OPPO Mobile Telecom.
R1-166613 Pairing or combining the two types of self-contained subframes Guangdong OPPO Mobile Telecom.
R1-166615 Discussion of the UE processing time on the support of multiple numerologies and frame structures Guangdong OPPO Mobile Telecom.
R1-166638 Proposals for frame structure NEC
R1-166662 MU-MIMO impact on frame structure for NR Sony
R1-166673 NR Frame structure considerations for low latency TDD operation Fujitsu
R1-166674 Discussion on flexible/dynamic TDD Fujitsu
R1-166675 Guard period setting in TDD based NR frame structure Fujitsu
R1-166676 TDD frame structure with mixed numerology Fujitsu

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R1-166756 Discussion on UL control channel structure for NR Samsung
R1-166757 Discussion on frame structure and HARQ timing Samsung
R1-166758 Discussion on time interval X Samsung
R1-166759 Discussion on URLLC support in NR Samsung
R1-166760 Discussions on reference signal design for NR Samsung
R1-166761 Dynamic TDD for NR Samsung
R1-166762 PDCCH Design Considerations Samsung
R1-166763 Discussion on wireless backhaul support Samsung
R1-166764 Discussion on NR subframe structure and control signaling Samsung
R1-166765 Discussion on resource block size in NR Samsung
R1-166766 Discussion on measurement support for single/multi-beam NR operation Samsung
R1-166767 Framework for multiplexing different verticals Samsung
R1-166880 Discussion on minimum HARQ-ACK and retransmission timing LG Electronics
R1-166881 Subframe and mini-subframe definition for frame structure of NR LG Electronics
R1-166882 Overall discussion on URLLC LG Electronics
R1-166883 Discussion on flexible duplex operation in NR design LG Electronics
R1-166884 Inter-cell interference coordination for flexible duplex operation LG Electronics
R1-166886 Handling URLLC in new RAT LG Electronics
R1-166887 Discussion on relay operation in NR LG Electronics
R1-166888 Discussion on multi-carrier operation between LTE and NR LG Electronics
R1-166889 On MBMS support in NR LG Electronics
R1-166940 Discussion on numerology multiplexing in NR ETRI
R1-166942 Frame structure for new radio interface ETRI
R1-167005 Discussion on frame structure Spreadtrum Communications
R1-167037 Demodulation reference signal design principles Ericsson
R1-167038 DMRS reuse for data and control Ericsson
R1-167039 On different HARQ reporting modes Ericsson
R1-167042 On FDD frame structure Ericsson
R1-167043 On sidelink frame structure Ericsson
R1-167044 On dynamic TDD Ericsson
R1-167045 On low-latency frame structure Ericsson
R1-167046 Summary ofn NR subframe design Ericsson
R1-167047 On smallest schedulable unit Ericsson
R1-167048 On subframe description Ericsson
R1-167049 On subframe scaling Ericsson
R1-167050 On symbol scaling Ericsson
R1-167051 On time interval X Ericsson
R1-167052 On multi-subframe scheduling for uplink transmissions Ericsson
R1-167053 On the number of HARQ processes Ericsson
R1-167079 Frame structure and DMRS positions Ericsson
R1-167080 Concatenated block RS design Ericsson
R1-167089 Discussion on NR operation in unlicensed spectrum ZTE
R1-167109 Discussion on frame structure design for NR CMCC
R1-167110 Discussion on Time Interval and TTI for NR CMCC
R1-167127 Frame structure considerations for URLLC Intel Corporation
R1-167203 Discussion on control channel design Huawei, HiSilicon
R1-167204 Discussion on reference signal design Huawei, HiSilicon
R1-167218 Numerology and Frame Structure for NR-Unlicensed Huawei, HiSilicon
R1-167262 Basic frame structure principles for New Radio Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-167263 On HARQ and scheduling timing for New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167264 On flexible RS design principles Nokia, Alcatel-Lucent Shanghai Bell
R1-167265 Frame Structure Support for Beam Based Common Control Plane Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-167266 On the unlicensed band operation in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167267 On the wireless relay / self-backhauling operation in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167268 On the sidelink operation in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167269 On the URLLC transmission formats for New Radio TDD Nokia, Alcatel-Lucent Shanghai Bell
R1-167330 Frame structure in NR INTERDIGITAL COMMUNICATIONS
R1-167331 Efficient multiplexing of traffic for different use cases INTERDIGITAL COMMUNICATIONS
R1-167395 Views on NR frame structure NTT DOCOMO, INC.
R1-167397 Views on NR demodulation RS NTT DOCOMO, INC.
R1-167440 NR time domain structure Panasonic Corporation
R1-167521 Latency Analysis for NR Frame Structure MediaTek Inc.
R1-167522 Flexible Frame Structure for New Radio Access Technology MediaTek Inc.

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R1-167584 Frame Structure for Channel Reciprocity Based Downlink MIMO in NR National Instruments Corp.
R1-167600 Discussions on the frame structure design for URLLC CATR
R1-167616 The feasible gap duration and association timing in NR SHARP Corporation
R1-167632 Signalling Framework to enable flexible Frame Structure for NR Motorola Mobility
R1-167732 Design Considerations on Guard Period for NR Frame Structure National Instruments Corp.
R1-167733 Discussion on NR frame structure CHTTL
R1-167739 Discussion on frame structure for NR III
R1-167744 IC friendliness vs configurable DMRS Ericsson
R1-167754 On Frame Structure for NR Innovative Technology Lab Co.
R1-167777 Considerations on Frame Structure for NR KT Corp.

8.1.4 Channel coding and modulation for new radi'o interface

R1-168418 Chairman's notes of AI 8.1.4 on channel coding and modulation for NR Ad-Hoc chair (Nokia)

8.1.4.1 Channel coding

Complexity comparisons

R1-166372 Channel coding evaluation of performance and implementation for EMBB Qualcomm Incorporated
R1-166557 Comparison of channel coding schemes for NR Intel Corporation
R1-166774 Discussion on complexity of NR candidate FECs Samsung
R1-166932 Implementation Consideration of Channel Coding Candidates for NR Ericsson
R1-166936 Survey of Channel Decoder Implementations Ericsson
R1-167213 Computational and implementation complexity of channel coding schemes Huawei, HiSilicon
R1-167272 Implementation aspects of eMBB coding schemes Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless, Xilinx
R1-167531 Area, Power and Latency Comparison for NR High Throughput Decoder MediaTek Inc.
R1-167567 Complexity comparison of channel coding candidates InterDigital Communications
R1-167713 Consideration points for implementation of flexible channel decoder LG Electronics Inc.

R1-166412 Complexity, throughput and latency analysis on channel coding candidates for NR ZTE
R1-166413 Consideration on channel coding for NR ZTE

R1-168103 WF on implementation complexity for eMBB coding scheme Nokia, ASB, Samsung, Ericsson, LG

Performance comparisons

R1-167895 Performance evaluation on channel coding candidates for NR ZTE
Revision of R1-166411
R1-166559 Performance of channel coding schemes for NR Intel Corporation
R1-167006 Performance comparison of channel coding schemes in the eMBB scenario Spreadtrum Communications
R1-167212 Performance of polar and LDPC codes for eMBB scenarios Huawei, HiSilicon
R1-167239 Field test results of channel coding schemes Huawei, HiSilicon
R1-167270 Performance of eMBB channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell
R1-167601 Some simulation results for different coding schemes CATR
R1-167624 Channel Coding for NR NTT DOCOMO, INC.

R1-166775 Discussion on throughput and latency of NR candidate FECs Samsung
R1-166892 Comparison of throughput and complexity for Turbo and LDPC codes LG Electronics
R1-167214 Channel coding schemes for URLLC scenario Huawei, HiSilicon
R1-167215 Channel coding schemes for mMTC scenario Huawei, HiSilicon
R1-167271 Performance of mMTC and URLLC channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell
R1-167565 Performance evaluation of channel coding for URLLC and mMTC InterDigital Communications
R1-167568 Channel coding simulation data sharing InterDigital Communications

R1-168163 WF on further channel coding simulation data sharing InterDigital, Qualcomm, Huawei, Ericsson, Samsung, MediaTek, LG, Nokia, ASB, ZTE, Intel, Sharp

Conclusion:

- Combined channel coding simulation data sharing is needed by filling in the base excel spreadsheets from participating companies
  - Example base excel spreadsheets are attached
  - Participating companies may add their data upon the combined excel spreadsheet and update the file version

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        - Offline emails can be used to track the updates: Moderator: Chunxuan Ye, Interdigital
    - Simulation curves may not be aligned given the same configuration, probably due to different codes or decoding algorithms
        - May need to specify further details of different channel codes
- Companies encouraged to further contribute, update and align their simulation results for RAN1 #86bis

R1-168285 WF on channel code evaluation for URLLC Qualcomm

Other comparisons

R1-166933	Latency Consideration of Channel Coding Candidates	Ericsson
R1-166934	Flexibility Consideration of Channel Coding Candidates	Ericsson
R1-167276	Evaluation criteria for URLLC and mMTC coding schemes	Nokia, Alcatel-Lucent Shanghai Bell

R1-168169 WF on Flexibility of Channel Coding Techniques Ericsson, Nokia, ASB, LG, Orange, IMT
Also supported by NEC.

Agreement:
- Channel coding techniques for NR, should support the following:
    - Info block size K flexibility:
        - Granularity at lower end of range of K = [D1] bits
            - D1 may be different for control and data channels
            - FFS whether D1 may be different for different code rates
        - FFS whether the granularity is coarser at higher values of K
        - Shortening (i.e. assigning info bits to known values, e.g. 0) may be used to provide info block size flexibility
    - Codeword size flexibility:
        - Basic code design with rate matching (i.e., puncturing and/or repetition) supports 1-bit granularity in codeword size

R1-167999 WF on Channel Coding Selection Qualcomm Incorporated, Samsung, Nokia, ASB, ZTE, MediaTek, Intel, Sharp, MTI, Interdigital, Verizon Wireless, KT Corporation, KDDI, IITH, CEWiT, Reliance-jio, Tejas Networks, Beijing Xinwei Telecom Technology, Vivo, Potevio, WILUS, Sony, Xiaomi
Also supported by Oppo.
Revision of R1-166376
Proposal:
- LDPC should be selected for eMBB data channel to provide performance and implementation advantages at high rate and large blocklength

R1-168040 WF on channel coding selection Huawei, HiSilicon, CMCC, CUCC, Deutsche Telekom, Orange, Telecom Italia, Vodafone, China Unicom, Spreadtrum
Not supported by Orange.
Proposal:
- Polar code is a candidate channel coding technique for NR for eMBB, URLLC, mMTC

R1-168164 WF on turbo code selection LG Electronics, Ericsson, CATT, NEC, Orange, IMT
Proposal:
- LTE turbo code should be supported for NR for at least low throughput including eMBB, mMTC, and URLLC
    - It can support flexibilities of information block sizes and code rates
    - Turbo code enhancement can be considered
- FFS: high throughput

Conclusion:
- The eMBB data channel coding scheme will be chosen at RAN1#86bis
    - including agreeing on the observations that led to the decision.
- Companies are encouraged to:
    - continue analysis and comparison in order to inform the final decision at RAN1#86bis
    - provide any remaining details, especially focusing on LDPC (in view of the situation in this meeting)
    - provide any remaining details of the flexibility requirements and how they can be satisfied, and corresponding implementation complexity and any impact on performance
- Note that consideration of combinations of coding schemes is not precluded.

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- In case of changes to proposals already available, companies are encouraged to provide them at least 1 week before the normal submission deadline for RAN1#86bis.

R1-168171 WF on HARQ for NR Ericsson, Nokia, ASB, LG, CATT, ZTE, Qualcomm, MediaTek, InterDigital, Intel, Orange, IMT

Agreement:

- Channel coding technique(s) designed for data channels of NR support both Incremental Redundancy (IR) (or similar) and Chase Combining (CC) HARQ

LDPC details

R1-166369	LDPC HARQ	Qualcomm Incorporated
R1-166370	LDPC rate compatible design	Qualcomm Incorporated
R1-166388	LDPC rate compatible design	Qualcomm Incorporated
R1-166414	Discussion on LDPC codes for NR	ZTE
R1-166475	Evaluation of binary LDPC codes for NR	CATT
R1-166476	Evaluation of non-binary LDPC codes for NR	CATT
R1-166558	Channel coding scheme for eMBB	Intel Corporation
R1-166768	Summary of channel coding for NR	Samsung
R1-166769	Discussion on length compatible Quasi-Cyclic LDPC codes	Samsung
R1-166770	Discussion on rate compatible Quasi-Cyclic LDPC codes	Samsung
R1-166771	Preliminary evaluation results on Quasi-Cyclic LDPC codes	Samsung
R1-166890	LDPC code design	LG Electronics
R1-166891	Performance evaluation of LDPC codes	LG Electronics
R1-166929	LDPC Code Design for NR	Ericsson
R1-166931	Impact of Shortening and Puncturing to LDPC Performance	Ericsson
R1-167211	LDPC codes for eMBB	Huawei, HiSilicon
R1-167273	LDPC design for eMBB	Nokia, Alcatel-Lucent Shanghai Bell
R1-167274	IR HARQ schemes for LDPC	Nokia, Alcatel-Lucent Shanghai Bell
R1-167532	Discussion on LDPC Coding Scheme of Code Structure, Granularity and HARQ-IR	MediaTek Inc.
R1-167659	Double QC-LDPC codes with degree-3 for NR	National Taiwan University

R1-168041 WF on performance verification Huawei

Polar coding details

R1-166371	Polar HARQ	Qualcomm Incorporated
R1-166415	Discussion on polar codes for NR	ZTE
R1-166772	Performance analysis on Polar codes	Samsung
R1-166773	Discussion on flexible Polar codes	Samsung
R1-166893	Discussion on polar code design	LG Electronics
R1-166894	Polar code performance evaluation	LG Electronics
R1-167209	Polar code design and rate matching	Huawei, HiSilicon
R1-167210	HARQ scheme for polar codes	Huawei, HiSilicon
R1-167240	On polar decoders	Huawei, HiSilicon
R1-167275	Design and Performance of polar codes for eMBB	Nokia, Alcatel-Lucent Shanghai Bell
R1-167566	Performance evaluation of puncturing schemes for Polar Codes	InterDigital Communications

Turbo coding details

R1-166473	Low complexity decoding algorithm for Turbo codes	CATT
R1-166474	Evaluation of dual-binary Turbo code for NR	CATT
R1-166897	Turbo code enhancement and performance evaluation	LG Electronics
R1-166930	Turbo Code for NR Scenarios	Ericsson
R1-167413	Enhanced Turbo Codes for NR: Implementation Details	ORANGE
R1-167414	Enhanced Turbo Codes for NR: Performance Evaluation	ORANGE

Coding for small blocks

R1-167277	Evaluation criteria for control channel coding	Nokia, Alcatel-Lucent Shanghai Bell
R1-166373	Short blocklength design	Qualcomm Incorporated

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R1-166477 Evaluation of TBCC codes for NR CATT
R1-166895 TBCC design LG Electronics
R1-166896 TBCC performance evalution LG Electronics
R1-166926 Further Discussion on Performance and Complexity of Enhanced TBCC Ericsson
R1-167992 Evaluation of Enhanced TBCC and Polar Codes Ericsson
Revision of R1-166927
R1-166935 Channel Coding Techniques for Control Information in NR Ericsson
R1-167216 Channel coding for control channels Huawei, HiSilicon
R1-167703 Channel coding scheme for URLLC, MMTC and control channels Intel Corporation
R1-167533 Examination of NR Coding Candidates for Low-Rate Applications MediaTek Inc.

R1-168170 WF on coding technique for control channel of eMBB Ericsson, Nokia, ASB, LG, NEC, Orange, IMT
Proposal:
- At least for control channel of eMBB UL and DL, tail-biting convolutional code (TBCC) is adopted as channel coding technique for NR
  - FFS: enhancements to LTE TBCC
  - FFS: if other coding techniques should also be included for control channel with info block size outside of 10-100 bits

R1-168024 WF on code selection for control channel Huawei, HiSilicon, CMCC, CUCC, Deutsche Telekom, Vodafone, MTK, Interdigital, Spreadtrum
Revision of R1-168042
Proposal:
- Polar code is considered as channel coding technique for NR for control channel UL and DL
  - Even a low complexity small list size polar decoder is shown to have a performance advantage over TBCC
- Further comparison of Polar and TBCC is encouraged

R1-168298 WF on control channel coding Nokia, ASB, LG, CATT, MediaTek
Revision of R1-168102
Agreement:
- Simulation Assumptions for eMBB control channel coding
  - Evaluate the block error rate (BLER) performance versus SNR
  - Evaluate the false alarm rate versus SNR

Channel	AWGN						
Modulation	QPSK						
Coding Scheme	Repetition	Simplex	TBCC	Turbo	LDPC	Reed-Muller	Polar
Code rate (for evaluation purposes)	1/24*, 1/12, 1/6, 1/3, 1/2, 2/3						
Decoding algorithm**	ML	ML	List-Viterbi	Scaled max log MAP	Adjusted min-sum	FHT	SC list
Info. block length (bits w/o CRC) (for evaluation purposes) ***	1, 2, 4, 8, 16, 32, 48, 64, 80, 120, 200						

* Code rate 1/24 is valid for info block length of 1-2 bits
** Other variants of agreed algorithms can be used for encoding and decoding (Complexity details should be illustrated)
*** Each of these info. block lengths shall be evaluated at at least one of the code rates. Other info. block lengths and code rates are not precluded. Similar info. and encoded block lengths should be used for the evaluation. Total coded bits = info. Block length/code rate. Note: these info. block length and code rate are only for initial performance evaluations. They are not interpreted as design targets or assumptions for complexity analysis.
- Companies are encouraged to provide information on complexity of their decoders, and on decoding latency.

Outer coding
R1-166374 Erasure coding and HARQ design Qualcomm Incorporated
R1-166375 Erasure coding evaluation methodology Qualcomm Incorporated
R1-166416 Discussion on outer codes for NR ZTE
R1-166898 Discussion on outer coding on eMBB data LG Electronics
R1-167913 Channel coding schemes for eMBB and URLLC Coexistence SHARP Corporation, MTI
Revision of R1-167617

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R1-168120 WF on URLLC impact handling ZTE, ZTE Microelectronics, Qualcomm, Sharp, MTI, InterDigital, Sony, Verizon Wireless, CATR, MediaTek
Conclusion:
Await outcome of eMBB/URLLC multiplexing discussions.

Other
R1-166928 HARQ Schemes for NR Ericsson

R1-167544 Data sharing on NR Channel Coding Simulation Result MediaTek Inc.

8.1.4.2 Modulation

R1-167054 On modulation schemes for NR Ericsson

R1-166899 Discussion on modulation schemes and maximum supported modulation order in NR LG Electronics

R1-166776 Discussion on modulation for NR Samsung

R1-166099 Advanced modulation for NR Huawei, HiSilicon
R1-166377 NR modulation requirements Qualcomm Incorporated
R1-166378 Evaluation assumptions for NR modulation schemes Qualcomm Incorporated
R1-166560 Power efficient modulation and waveform processing Intel Corporation
R1-166649 Performance of NU-QAM with Turbo codes for the NR Sony
R1-166777 Modulation scheme for MIMO Samsung
R1-167278 Digital Modulation for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167569 Performance evaluation of Spatial Modulation for New Radio InterDigital Communications
R1-167570 Performance evaluation of Dual Carrier Modulation for New Radio InterDigital Communications
R1-167578 On Fractional N-ary Modulation for NR InterDigital Communications

8.1.5 Multi-antenna scheme for new radio interface

Discuss initial views on multi-antenna scheme including analog/digital/hybrid beam-forming

R1-167291 Digital subsystem with hybrid beamforming Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
The document was presented by Mihai Enescu from Nokia.

- Observation 1: Operating using hybrid transceiver architecture suffers from increased scheduling latency and system overhead compared to digital architectures. Especially UL control signaling is expensive with hybrid architecture.
- Observation 2: Widening the RX beams for UL control may be used in some situations but would be far from optimal solution.
- Observation 3: Full digital subsystem could be implemented in cost efficient manner along with hybrid architecture.
- Observation 4: Full digital subsystem has high potential to improve hybrid architecture operation significantly.
- Proposal 1: Define UL control signal and channel and RS structures in a way to allow optimizing BS hybrid implementation with full digital RX subsystem:
  - narrowband resource allocation structures with flexible allocation and scheduling possibility
  - signal design to enable high multiplexing capability for the control signals like scheduling request

Decision: The document is noted.

R1-166089 Beam Management Procedure for NR MIMO Huawei, HiSilicon
The document was presented by Leiming Zhang from Huawei.

- Proposal 1: The following beam refinement procedures should be studied in NR, including reliability performance, overhead and so on.
  - DL or UL based joint TRP and UE beam refinement
  - DL or UL based UE beam refinement only
  - DL or UL based TRP beam refinement only
- Proposal 2: Beam probing for best beam(s) and angle estimation should be considered in NR.
- Proposal 3: A mechanism and signaling for fast link recovery among TRPs should be supported in NR.
- Proposal 4: Control beam(s) derived from the data beam(s) and using the refinement beams for control signal transmission should be considered in NR
- Proposal 5: Beam management procedures taking LF assisted control signalling transmission for HF should be taken into considerations in the overall beam management.

Decision: The document is noted.

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R1-167466 Key principles for beam management Ericsson

The document was presented by Mattias Frenne from Ericsson.

- Beam management is handled by L1/L2 procedures
- Strive to handle beam management within the CSI framework in NR (i.e. the framework used for link adaptation of data transmission).
- In the beam management procedures, one or multiple beam pair links (BPLs) are monitored by the network using uplink measurements by the TRPs and/or downlink measurements from the UE
- Support a sweep of BMRS in different TRP beams to allow for a measurement per TRP beam in the UE.
- Consider supporting a repetition of BMRS in the same TRP beam to allow for measurement of the TRP beam in different UE receive beams.

Decision: The document is noted.

R1-166379 Downlink MIMO transmission schemes Qualcomm Incorporated

The document was presented by … from Qualcomm.

- Proposal 1: The NR DL MIMO shall support CLSM using antenna ports with UE RSs.
- Proposal 2: For CLSM, the precoding granularity can be a single RE.
- Proposal 3: The NR MIMO shall support open-loop spatial multiplexing using antenna ports with UE RSs.
- Proposal 4: Study performance benefit of UE RS based open-loop spatial multiplexing with precoder cycling and small cyclic delay diversity.
- Proposal 5: Study performance benefit of UE RS based open-loop spatial multiplexing with implicit and explicit precoding.
- Proposal 6: The NR MIMO shall support transmit diversity using antenna ports with UE RSs.
- Proposal 7: Study performance benefit of UE RS based SFBC with transparent FSTD and non-transparent FSTD.
- Proposal 8: The NR MIMO shall support reciprocity based spatial multiplexing using antenna ports with UE RS.
- Proposal 9: For reciprocity based spatial multiplexing, the precoding granularity can be a single RE.
- Proposal 10: The NR MIMO may consider dynamic switching between close-loop and open-loop operations in addition to dynamic switching between spatial multiplexing and transmit diversity.

Decision: The document is noted.

WFs on Beam Management

R1-167951 WF on digital sub-system with hybrid beamforming Nokia, ASB

The document was presented by Mihai Enescu from Nokia.

- Support enhancing hybrid architecture operation using digital RX subsystem consisting of the same (or similar) amount of RxRUs as the number of antenna elements.
- UL Signal design and UL control channel design needs to follow the following principles:
  - Transmission bandwidth of the UL control signal and associated demodulation UL RS is significantly smaller than the system bandwidth, e.g. 10/20 MHz bandwidth.
  - UL Signal design to enable high multiplexing capability for the UL control signals like scheduling request.
  - Efficient joint operation of hybrid RX and digital RX, e.g. efficient utilization of UL data and UL control channels.

Discussion: Interference between narrowband and wideband should also be listed
Decision: The document is noted. Continue offline discussion until Tuesday – (Nokia)

R1-167962 WF on NR MIMO calibration ZTE Corporation, ZTE Microelectronics, Intel Corporation, Samsung

The document was presented by Ruyue Li from ZTE.

- RAN1 starts NR MIMO calibration to reach common ground for MIMO related evaluation:
- Link-level calibration
  - Support the subsequent link-level evaluation for candidate designs/approaches, e.g., reference signals;
  - Calibration assumptions and metrics are FFS;
- System-level calibration
  - Support the subsequent system-level evaluation for candidate designs/approaches, e.g., multi-beam sweeping/ selection/reporting;
  - Calibration assumptions and metrics are FFS;
- Approve the following scenario/channel model for link and system levels calibration:
- Link-level: CDL model with random angular offset, e.g.,
  - 3GPP TR38.900 CDL-A model (Delay spread = 10 ns)
  - 3GPP TR38.900 CDL-D model (Delay spread = 10 ns)
  - Mobility: 3km/h
  - Other details FFS

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- Notes: The angles should be wrapped around to be uniformly within 0-360 degrees in azimuth and clipped within 0-180 degrees in zenith angle via applying uniform-distribution translation angle in Section 7.7.5.1 in TR 38.900 accordingly.
- System-level: Indoor hotspot, urban macro, dense urban
  - Other details FFS

Discussion: Also supported by ASTRI, Xinwei, Mediatek
Decision: The document is noted. Continue offline discussion until Tuesday – (ZTE: R1-168273)

R1-168273 WF on NR MIMO calibration ZTE Corporation, ZTE Microelectronics, Intel Corporation, Samsung, ASTRI, Xinwei, MediaTek, Nokia, ASB, Ericsson, NTT DOCOMO, Qualcomm

R1-168487 WF on NR MIMO calibration ZTE Corporation, ZTE Microelectronics, Intel Corporation, Samsung, ASTRI, Xinwei, MediaTek, Nokia, ASB, Ericsson, NTT DOCOMO, Qualcomm, CATT
Agreements:

- For the purpose of calibration, companies are encouraged to provide baseline results for NR MIMO in the following meetings, including link-level and system level simulations
  - Discuss further on baseline simulation assumptions and metrics for calibration in email discussion after RAN1#86
  - Thereafter, email reflector is used to collect results (no online time for calibration discussions, similar to channel model calibration)
- Email discussion till 8th September ~~next meeting~~ to initiate by Ruyue (ZTE)
  - Including detailed simulation parameters for UE movement, rotation and/or channel/beam blockage is FFS – (to be included in Ruyue's email discussion)

R1-167950 WF on beam management Intel Corporation, Ericsson
The document was presented by Yuan Zhu from Intel.

- Distinguish two beam related procedures:
  - **Procedure A** is used to support beam based mobility
    - Main purpose is to discover TRP TX beams and perform mobility related measurements
    - UE RX beam training support may also be considered
    - Searching and discovering TRP TX beams from neighbor TRPs which are non-synchronized is supported
      - Note: TRPs may still be synchronized but the UE shall not make such assumption
    - L3 reporting
  - **Procedure B** is used to support beam management
    - Purpose is to track TRP TX beams and support UE to select UE RX beams
    - RS (beams) to measure on are explicitly configured to the UE
      - Note: No search/discovery procedure is involved
    - L1/L2 reporting

Discussion: Samsung asked for more time, not a simple change.
Decision: The document is noted.

R1-167961 WF on aperiodic beam sweeping and CSI reporting ZTE
The document was presented by Ruyue Li from ZTE.

- Study the following aspects of aperiodic beam sweeping:
  - Three types of beam sweeping for both UL and DL:
    - TRP beam sweeping only, keeping a fixed UE beam
      - supporting measuring multiple TRP beams by the same UE beam
    - UE beam sweeping only, keeping a fixed TRP beam
      - supporting measuring the same TRP beam with multiple UE beams
        - E.g. by time domain replica waveform. TRP Tx using the same TRP beam and UE receives using one UE beam per replica
        - E.g. by multiple wider sub-carrier spacing based OFDM symbols. TRP Tx using the same TRP beam and UE receives each symbol with different UE beam
    - Joint TRP and UE beam sweeping
  - Indication of TX and/or RX beam on control/feedback signaling:
    - Indication is per beam or per beam group
  - Content of aperiodic CSI report e.g. RSRP, RI/PMI/CQI, beam ID
  - NOTE: support various mobility scenarios
  - Others are not precluded
- Study aperiodic CSI in conjunction with aperiodic RS transmission:
  - Dynamic indication of aperiodic reference signal and interference measurement resource including

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- Aperiodic reference signal for channel measurement for CSI feedback and beam selection/training
- Aperiodic interference measurement resource for interference measurement, including using non-zero power reference signal
- Resource pool sharing for aperiodic channel and interference measurement resources
- DMRS based CSI feedback including CQI adjustment and beam refinement
  - Study the timing requirement among aperiodic CSI triggering, aperiodic RS transmission and CSI feedback.
    - Timing between CSI triggering and aperiodic RS transmission X
    - Timing between aperiodic RS transmission and CSI/beam feedback Y
- Others are not precluded

Decision: The document is noted.

R1-167947 WF on Beam Management Huawei, HiSilicon, Potevio

The document was presented by Leimin Zhang from Huawei.

- Study on the following aspects for beam management
  - TRP(s) used to transmit beam management RS is transparent to UE
  - Beam management procedure based on L1 and L2 procedure
  - Beam management procedure based on LF assisted HF
  - Beam management includes the following two stages:
    - Coarse beam alignment, i.e., periodic beam sweeping without prior acquired beam(s) information
    - Fine beam alignment, i.e., periodic/aperiodic beam sweeping with prior acquired beam(s) information
      - Strive to handle this procedure within a unified CSI framework in NR
      - Fast link recovery procedure due to UE movement/rotation/blockage
        - » E.g., Monitoring multiple beam pairs for link recovery
      - Beam probing based beam refinement/tracking
        - » E.g., beam selection, or angle estimation
- RS design principle of Beam Management
  - DL beam management can be based on DL DMRS in addition to DL RS dedicated to CSI acquisition and beam management
  - UL beam management can be based on SRS, UL DMRS and energy-efficient UE-specific tracking signals

Decision: The document is noted.

R1-167966 WF on Beam Management CATT, Samsung

The document was presented by Rakesh Tamrakar from CATT.

- RAN1 should study beam management procedures under different channel reciprocity assumptions
  - At a TRP or UE, with TX and RX channel reciprocity (e.g., beam reciprocity), TX beam (or RX beam) can be obtained from RX beam (or TX beam) to reduce overhead and latency
  - Without TX and RX channel reciprocity, beam management procedure may require TX and RX beam sweeping in both DL and UL links
- RAN1 should study different methods of determining a beam pair for communication, e.g.,
  - Joint determination: Tx beam and Rx beam of the beam pair are determined jointly
  - Separate determination: Tx beam or Rx beam of the beam pair are determined sequentially
- Study beam management procedure with and without explicit indication of beam(s) used for data/control channel or reference signal transmission

Decision: The document is noted.

Continue offline discussion until Tuesday – (Intel, ZTE, CATT, Huawei)

R1-168119 WF on beam management Intel Corporation, Nokia, Alcatel-Lucent Shanghai Bell, Verizon

- The following two DL beam management procedures are supported:
  - Procedure A for beam selection without prior acquired beam(s) information (can be called as beam acquisition)
    - For initial beam acquisition and maintenance
    - UE RX beam training is also supported
    - [for TRPs not necessarily having common baseband/sync or having non-ideal backhaul.
    - option 1: Measurement reports on L3; option 2: Measurement reports can be L2/L1 and/or L3]
  - Procedure B for beam selection with prior acquired beam(s) information (can be called beam adjustment)
    - B-1: to support inter/intra-TRP Tx beam change within an NR cell for the same UE Rx beam
    - B-2: to support UE Rx beam change for the same TRP Tx beam
    - Intra-TRP and inter-TRP beam management follow the same procedure
      - Note: UE may or may not need to know the TRP has changed for inter-TRP Tx beam change
    - [option 1: L1/L2 procedure; option 2: L3 is involved as well]
    - Note: Procedures B-1&B-2 can be performed jointly
    - Note: Procedures B-1&B-2 can be performed multiple times to achieve e.g. TRP Tx/UE Rx beam change simultaneously

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- Support managing multiple Tx/Rx beam pairs for a UE for fast link recovery
- Assistant information from another carrier (e.g., LF carrier) can be utilized in procedures A&B
  - E.g.. LF carrier is used to feedback the measurement for HF

Decision: The document is noted.

Possible agreements:

- The following two DL beam management procedures are supported:
  - Procedure A for initial beam acquisition without prior acquired beam(s) information (can be called as beam acquisition)
    - TRP TX beam and UE RX beam sweeping are supported
    - [Procedure A can be considered for mobility]
  - Procedure B for beam change with prior acquired beam(s) information (can be called beam adjustment)
    - B-1: to support inter/intra-TRP Tx beam change [within multiple TRPs] for the same UE Rx beam
    - B-2: to support UE Rx beam change for the same TRP Tx beam
    - Strive for the same procedure design for intra-TRP and inter-TRP beam management
      - Note: UE may not know the TRP has changed for inter-TRP Tx beam change
    - Note: Procedures B-1&B-2 can be performed jointly
    - Note: Procedures B-1&B-2 can be performed multiple times to achieve e.g. TRP Tx/UE Rx beam change simultaneously
    - [Procedure B can be considered for mobility]
  - Support managing multiple Tx/Rx beam pairs for a UE for fast link recovery
  - Assistant information from another carrier (e.g., LF carrier) can be utilized in procedures A&B
    - E.g., low frequency carrier is used to feedback the measurement for high frequency
  - [Procedure A can be used for beam maintenance]

Continue offline discussion until Wednesday – Yuan (Intel)

R1-168278 WF on DL beam management Intel Corporation, Huawei, HiSilicon, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Verizon, MTK, LGE, NTT DoCoMo, Xinwei

Agreements: The following DL L1/L2 beam management procedures are supported within one or multiple TRPs:

- P-1: is used to enable UE measurement on different TRP Tx beams to support selection of TRP Tx beams/UE Rx beam(s)
  - For beamforming at TRP, it typically includes a intra/inter-TRP Tx beam sweep from a set of different beams
  - For beamforming at UE, it typically includes a UE Rx beam sweep from a set of different beams
  - FFS: TRP Tx beam and UE Rx beam can be determined jointly or sequentially
- P-2: is used to enable UE measurement on different TRP Tx beams to possibly change inter/intra-TRP Tx beam(s)
  - From a possibly smaller set of beams for beam refinement than in P-1
  - Note: P-2 can be a special case of P-1
- P-3: is used to enable UE measurement on the same TRP Tx beam to change UE Rx beam in the case UE uses beamforming
- Strive for the same procedure design for Intra-TRP and inter-TRP beam management
  - Note: UE may not know whether it is intra-TRP or inter TRP beam
- Note: Procedures P-2&P-3 can be performed jointly and/or multiple times to achieve e.g. TRP Tx/UE Rx beam change simultaneously
- Note: Procedures P-3 may or may not have physical layer procedure spec. impact
- Support managing multiple Tx/Rx beam pairs for a UE
- Note: Assistance information from another carrier can be studied in beam management procedures
- Note that above procedure can be applied to any frequency band
- Note that above procedure can be used in single/multiple beam(s) per TRP
- Note: multi/single beam based initial access and mobility treated within a separate RAN1 agenda item

R1-168322 Definitions supporting beam related procedures Nokia, Qualcomm, CATT, Intel, NTT DoCoMo, Mediatek, Ericsson, ASB, Samsung, LG

The document was presented by Mihai Enescu from Nokia.

- **Beam management** = a set of procedures to acquire and maintain a set of TRP(s) and/or UE beams that can be used for DL and UL transmission/reception, which include at least following aspects:
  - **Beam selection**= for TRP(s) or UE to select of its own beam(s).
  - **Beam measurement** = for TRP(s) or UE to measure characteristics of received beamformed signals
  - **Beam reporting** = for UE to report a property/quality of beamformed signal(s) based on beam measurement
  - **Beam sweeping** = operation of covering a spatial area, with beams transmitted and/or received during a time interval in a predetermined way.

Discussion: Ericsson → can a note be added that these are not related to mobility?

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Decision: The document is noted.

R1-168468 Definitions supporting beam related procedures Nokia, Qualcomm, CATT, Intel, NTT DoCoMo, Mediatek, Ericsson, ASB, Samsung, LG

R1-167965 WF on CSI measurement and reporting in NR Huawei, HiSilicon

The document was presented by Ming Lei from Huawei.

- A unified CSI acquisition framework should be studied in NR, which shall support
  - CSI measurement based on CSI-RS
  - Beam measurement based on RS for beam management
  - Implicit and explicit CSI feedback
  - Reciprocity based CSI acquisition
- The implicit CSI feedback methods should be studied in NR
  - Codebook design
  - Interference measurement results obtained from
    - ZP CSI-RS
    - NZP CSI-RS
    - DMRS
  - Beam measurement results
- The explicit CSI feedback_methods should be studied in NR
  - Feedback of channel covariance matrix
    - E.g. based on Kronecker-product
  - Feedback of channel matrix or channel eigenvector
    - E.g. based on multi-beam combination
  - Both quantized and unquantized/analog feedback
- Multi-level CSI measurement and reporting with the following features should be supported in NR
  - Joint feedback of wideband/long-term and subband/short-term CSI
  - Based on hybrid non-precoded and beamformed CSI-RS
  - Joint feedback of explicit CSI and implicit CSI
- At least the following CSI measurement and reporting mechanisms should be studied by NR
  - Aperiodic CSI measurement and reporting
  - Semi-persistent CSI measurement and reporting
- Self-contained CSI triggering, measurement and reporting in a 'time interval X' should be studied in NR
  - Note: here the definition of 'time interval X' follows the agreements in RAN1#85 meeting

Decision: The document is noted. Continue offline discussion until Tuesday – (Huawei)

R1-168179 WF on CSI measurement and reporting in NR Huawei, HiSilicon, Ericsson, China Telecom

Decision: The document is noted and modified as follows:

Agreements:

- A simplified CSI acquisition framework should be studied in NR, which could support
  - CSI measurement based on CSI-RS (if supported)
  - Implicit and explicit CSI feedback
  - CSI acquisition based on different degree of reciprocity
  - Other features to be supported
- The implicit CSI feedback methods should be studied in NR
  - Codebook design
  - Interference measurement based on interference measurement resource which could be one or more of the following options
    - ZP CSI-RS (if supported)
    - NZP CSI-RS (if supported)
    - DMRS (if supported)
    - Other resources are not precluded
  - CSI feedback based on DMRS (if supported)
- The explicit CSI feedback_methods should be studied in NR
  - Feedback of channel covariance matrix
  - Feedback of channel matrix
  - Feedback of channel eigenvector
  - Both quantized and unquantized/analog feedback
  - Other methods are not precluded
- CSI measurement and reporting with the following components should be studied in NR
  - Wideband/long-term CSI
  - Subband/short-term CSI

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- Explicit CSI
- Implicit CSI
- Configuration of the above components individually or jointly is FFS

R1-167964 WF on DL Transmission Scheme Huawei, HiSilicon, NEC

- NR should support the multiplexing of different transmission schemes to different UEs at the same time-frequency resource (an example is shown by Figure 1)
- NR should support beam based transmit diversity
  - Beam based transmit diversity based on single-TRP transmission should be supported in NR
  - Beam based transmit diversity based on multi-TRP transmission should be supported in NR (an example is shown by Figure 2)
  - Beam based transmit diversity is based on DM-RS for demodulation
  - Beam based transmit diversity should be the fallback scheme of the multi-antenna based transmission mode
- The dynamic switching between different transmission schemes should be supported in a transmission mode

Decision: The document is noted.

R1-166788 Discussion on DL MIMO transmission schemes and modes in NR Samsung

- Study a unified MIMO transmission chain framework to support various transmission techniques (including DMRS based SM, TxD and RE-level precoder cycling), considering the following aspects:
  - Number of CWs
  - Whether to reuse CW-to-layer mapping and precoding framework or to design a new framework
  - DCI design alternatives – modular vs format-based

Decision: The document is noted.

Possible agreements:

- NR should support the multiplexing of different transmission schemes to different UEs at the same time-frequency resource (an example is shown by Figure 1)
- NR should support beam based transmit diversity
  - Beam based transmit diversity based on single-TRP transmission should be supported in NR
  - Beam based transmit diversity based on multi-TRP transmission should be supported in NR (an example is shown by Figure 2)
  - Beam based transmit diversity is based on DM-RS for demodulation
  - Beam based transmit diversity should be the fallback scheme of the multi-antenna based transmission mode
- The dynamic switching between different transmission schemes should be supported in a transmission mode

Continue offline discussion until Wednesday – (Huawei, Samsung)

Wednesday

R1-168271 WF on DL Transmission Scheme Huawei, HiSilicon, NEC, Intel

- RAN1 to study multiplexing of different transmission methods to different UEs at the same time-frequency resource
- RAN1 to study transmit diversity
  - SFBC
  - SFBC-FSTD
  - Other schemes are not precluded
  - Demodulation reference for transmit diversity is DM-RS
    - QCL with other types of RS should be studied
- Support dynamic switching between different transmission methods
  - One of the transmission methods shall be transmit diversity
- Note: the multiple antenna ports used for transmit diversity can be on different beams and/or on different TRPs and/or different polarizations

Decision: The document is noted.

R1-168394 WF on DL Transmission Scheme Huawei, HiSilicon, NEC , Intel, Samsung
R1-168476 WF on DL Transmission Scheme Huawei, HiSilicon, NEC , Intel, Samsung

Agreements:

- RAN1 to study transmit diversity for both data and control channels
  - Aspects to related to QCL (if any), # of ports, polarizations, etc.
- Demodulation reference signal for transmit diversity, if supported, could be
  - UE-specific RS (if supported by NR)
  - Shared (by two or more UEs)-RS (if supported by NR)
  - Other types of RS are not precluded

R1-168105 WF on Framework for NR MIMO Samsung, Ericsson

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- Strive to design a unified CSI framework, avoiding introducing multiple classes/subclasses and unnecessary (equally performing) configurations, while still covering a wide variety of use cases
- Strive to remove tight coupling (e.g. fixed timing relationships, joint configuration) between the following modular functions
  - CSI-RS transmission
  - CSI measurement
  - CSI reporting
  - Multi-antenna transmission method
  - Downlink control signaling
- Consider supporting independent scheduling/configuration of CSI-RS, CSI report and data transmission
- At least for DL and except for non-spatial transmit diversity, per layer DMRS is supported
  - Note: the precoding is assumed to be the same for the layer and the associated DMRS
- At least 8 orthogonal DMRS ports is supported for SU-MIMO scheduling
  - Consider further the need for more than 8 orthogonal DMRS ports for MU-MIMO scheduling
- Support dynamic switching between transmission methods, e.g. between
  - Spatial transmit diversity (e.g. for control channels)
  - Spatial multiplexing

Decision: The document is noted.

Agreements:

- Strive to design a unified CSI framework, avoiding introducing multiple classes/subclasses and redundant (equally performing) configurations, while still covering a wide variety of use cases and frequency bands
- Coupling/Decoupling (e.g. fixed timing relationships, joint configuration) between the following functions should be studied
  - RS transmission used for CSI acquisition (CSI-RS transmitted in DL and SRS transmitted in UL)
    - Use of other RS(s) is not precluded (e.g., DMRS)
    - Note that CSI-RS and SRS may or may not have the same physical signal design
    - Note that the reference signal naming can be revisited later
  - CSI measurement/reporting
  - Multi-antenna transmission method/scheme
  - Downlink control signaling
- Study flexible scheduling/configuration of CSI-RS, CSI report and transmission method/scheme for data and control
- DL DMRS and UL DMRS based spatial multiplexing (SU-MIMO/MU-MIMO) is supported
  - FFS: Necessity of sidelink spatial multiplexing
- At least 8 orthogonal DL DMRS ports is supported for SU-MIMO scheduling
- At least 8 orthogonal DL DMRS ports is supported for MU-MIMO scheduling
- Support dynamic switching between transmission methods/schemes, e.g. between
  - Transmit diversity
  - Spatial multiplexing

R1-168254 WF on UL MIMO transmission Huawei, HiSilicon, China Unicom, Samsung, NTT DOCOMO

The following aspects for UL MIMO transmission should be supported:

- Transmission schemes for both reciprocity calibrated UEs, reciprocity non-calibrated UEs, and non-reciprocity case
  - UE capability which indicates calibration accuracy for UL reciprocity based operation should be introduced
- Codebook based transmission
  - Frequency selective precoding should be considered for large system bandwidth
  - E.g., UE–aided and eNB-centric
- Non-codebook based transmission
  - E.g., reciprocity based (based on DL RS) transmission only for calibrated UEs
  - E.g., UE–aided and eNB-centric: UE recommends candidate UL precoders to eNB based on DL RS measurement , and BS determines the final precoder.

Decision: The document is noted.

Agreements:

The following aspects for UL MIMO transmission should be supported:

- Transmission schemes/methods for reciprocity calibrated UEs, reciprocity non-calibrated UEs, and non-reciprocity/partial reciprocity cases

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- If needed, signalling associated with UL reciprocity based operation is introduced, e.g. UE capability which indicates calibration accuracy
- Whether to differentiate reciprocity non-calibrated UEs from non-reciprocity or not is to be studied
- Note: the number of transmission schemes/methods can be further discussed

- At least one of the following candidate schemes/methods is to be supported
  - Candidate 1: Codebook based transmission
    - Frequency selective and frequency non-selective precoding in digital domain can be considered for large system bandwidth
      - The support for frequency selective precoding is conditioned on decision on NR waveform(s)
      - FFS: The values of the large system bandwidth
    - E.g., BS-centric mechanism analogous to LTE
    - E.g., UE–aided and BS-centric mechanism: UE recommends candidate UL precoders from a predefined codebook to BS based on DL RS measurement, and BS determines the final precoder taken from the codebook.
    - E.g., UE–centric and BS-aided mechanism: BS provides CSI (e.g. channel response, interference-related information) to the UE, and the UE determines the final precoder based on the information from the BS
  - Candidate 2: Non-codebook based transmission
    - Frequency selective and frequency non-selective precoding in digital domain can be considered for large system bandwidth
      - The support for frequency selective precoding is conditioned on decision on NR waveform(s)
      - FFS: The values of the large system bandwidth
    - E.g., reciprocity based (based on DL RS) transmission only for calibrated UEs
    - E.g., UE–aided and BS-centric mechanism: UE recommends candidate UL precoders to BS based on DL RS measurement, and BS determines the final precoder.
    - E.g., UE–centric and BS-aided mechanism: BS provides CSI (e.g. channel response, interference-related information) to the UE, and the UE determines the final precoder based on the information from the BS
  - Note: Other transmission schemes/methods are not precluded.

R1-168173 WF on Frequency Selective Precoding for NR UL MIMO Samsung, Intel, NTT DOCOMO, Huawei

- Frequency selective UL precoding (at least for digital beamforming) should be studied in NR
  - Study UL precoder signaling
    - Example 1: Signaling of multiple PMIs (subband) via single or two-level DCIs
    - Example 2: Signaling of multiple PMIs via Data channel
    - Example 3: For TDD, precoder calculation at the UE based on DL RS
      - For TDD and reciprocity calibrated UE, UE recommends candidates UL precoders to BS based on the DL RS measurement, BS determines the final precoder
  - Study the use of UL frequency selective precoding for both dynamic beamforming and semi-dynamic beamforming
  - Study UL subband size (i.e. UL precoding granularity) considering following aspects
    - Implicit (defined by spec.) or explicit (by eNB/UE decision) signaling support
    - Whether to Align with DL or not

Decision: The document is noted and modified as follows:

Agreements:

- Study UL precoder signaling for frequency selective/non-selective precoding
  - Example 1: Signaling of single or multiple PMIs via DL control and/or data channels
    - Multiple PMIs can be signaled via a single DCI or multi-level DCI (1st level DCI contains a location indication to the 2nd level DCI)
  - Example 2: For TDD, precoder calculation at the UE based on DL RS
  - Notes:
    - The feasibility of frequency selective precoding is conditioned RAN1 decision on, e.g. NR frame structure, waveform(s)
    - Impact on other system design aspects (e.g. DL control channel decoding performance/complexity) should be considered.
- Study the use of UL frequency selective precoding for precoded transmission including precoder cycling
- For frequency selective precoding, study UL precoding granularity (i.e. UL subband size) considering following aspects
  - Implicit (defined by spec.) or explicit (by eNB/UE decision) signaling support
  - Whether to align with DL or not
- Evaluation should include UL specific aspects such as CM analysis according to UL waveform, etc.
- Study of frequency non-selective precoding is of higher-priority

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QCL

R1-167970 WF on the antenna ports QCL in NR Intel, LGE, Ericsson, Samsung, InterDigital, Huawei/HiSilicon

Decision: The document is noted.

Agreements:

- All physical channels and reference signals in NR are transmitted using antenna ports
- Agree as working assumption the following antenna port definition for NR (same as in LTE)
  - An antenna port is defined such that the channel over which a symbol on the antenna port is conveyed can be inferred from the channel over which another symbol on the same antenna port is conveyed.
- Working assumption: Parameters for antenna port QCL in NR includes at least (if QCL is supported)
  - Average gain, average delay, delay spread, Doppler shift and Doppler spread (same as in LTE)
  - Additional parameters are FFS
- FFS whether the QCL or other means can be used for UE beamforming management
- The following QCL assumptions for DM-RS antenna ports in NR are for further study
  - QCL across DM-RS antenna ports
    - All the DMRS antenna ports are QCL-ed with each other
    - Not all the DMRS antenna ports are QCL-ed with each other
  - QCL across scheduled PRBs for DM-RS antenna port
  - QCL among DM-RS antenna port groups
  - QCL of DM-RS antenna ports with antenna ports of other reference signals (RS to be defined in NR)
  - Other assumptions are not precluded
- Note: The antenna ports of demodulation reference signal (DM-RS) in NR are used to transmit at least physical data and, possibly, control channels and used at the UE for demodulation.

R1-168272 WF on QCL assumptions in NR Huawei, HiSilicon, China Telecom, DoCoMo, CATR, Intel

Decision: The document is noted.

Possible agreements:

- No QCL by default in NR unless otherwise specified

Possible agreements:

- For the QCL assumptions and configurations, the following should be supported:
  - By default, no QCL assumptions in NR for the following cases unless otherwise indicated
    - FFS: between synchronization signals and CSI-RS (if supported)
    - between synchronization signals and DMRS (if supported)
  - By default, no QCL assumptions for antenna ports transmitted in different time occasions (e.g. different subframes or TTIs) in NR unless otherwise indicated
  - With explicit or implicit indications, NR should
    - support multiple QCL configurations
    - support flexible QCL configurations at least for the following cases:
      - FFS: Among CSI-RS ports (if supported)
      - Between different types of antenna ports
      - FFS: among other types of RS ports in addition to CSI-RS and DMRS (if supported)
    - Note: The definition of explicit indication is NR BS notifies the UE by the signaling about QCL configuration
  - Note: QCL configuration is defined as the different sets of large-scale channel properties and, in case of explicit signaling, the supporting signaling mechanism to notify the UE

Continue offline discussion until Thursday – Ming (Huawei)

R1-168360 WF on QCL assumptions & configurations in NR Huawei, HiSilicon, China Telecom, DoCoMo, CATR, Intel

R1-168436 WF on QCL assumptions & configurations in NR Huawei, HiSilicon, China Telecom, DoCoMo, CATR, Intel

Agreements:

- All QCL assumptions that a UE is allowed to make among antenna ports should be identified and explicitly specified
- QCL is defined as follows:
  - Two antenna ports are said to be quasi co-located if properties of the channel over which a symbol on one antenna port is conveyed can be inferred from the channel over which a symbol on the other antenna port is conveyed.
  - Future refinement on QCL definition is not precluded

R1-168388 WF on beam management CATT, Samsung, National Instruments, ZTE

Agreements:

- Consider different channel reciprocity assumptions in beam management procedures

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  - At a TRP or UE, with TX and RX channel reciprocity (full or partial) (e.g., beam reciprocity), TX beam (or RX beam) can be obtained from RX beam (or TX beam) to reduce overhead and latency
  - Without TX and RX channel reciprocity, beam management procedure may require TX and RX beam sweeping in both DL and UL links
- RAN1 study different methods of determining Tx and Rx beam(s) for communication on one link direction (uplink or downlink), e.g.,
  - Joint determination: Tx beam and Rx beam are determined jointly
  - Separate determination: Tx beam or Rx beam are determined sequentially.
  - Multi-stage determination: for instance, coarse Tx-Rx beam determination followed by fine Tx-Rx beam determination
- Study beam management procedure with and without explicit signaling of beam(s) or beam group(s) used for transmission

R1-168386 WF on aperiodic CSI reporting ZTE Corporation, ZTE Microelectronics, ASTRI, Intel Corporation, Samsung, CATT

Agreements:

Study aperiodic CSI reporting in conjunction with aperiodic RS transmission:

- Dynamic indication of aperiodic RS and interference measurement resource including
  - Aperiodic RS for channel measurement for CSI reporting
  - Aperiodic interference measurement resource for interference measurement, including using non-zero/zero power RS, demodulation RS;
  - Resource pool sharing for aperiodic channel and interference measurement resources
- Study the timing requirement among aperiodic RS triggering, CSI reporting triggering, aperiodic RS transmission, and CSI reporting.
  - Timing between CSI triggering and aperiodic RS transmission X
  - Timing between aperiodic RS transmission and CSI reporting Y
  - Notes: Consider the single triggering for RS transmission and CSI reporting;
- Others are not precluded
- Note: aperiodic triggering doesn't preclude on-demand (using activate/release mechanism) triggering

R1-168186 WF on periodic and semi-persistent CSI for NR Samsung, Ericsson, Qualcomm

Agreements:

- Support at least one of the following schemes for CSI reporting:
  - Scheme 1: periodic CSI reporting analogous to LTE
  - Scheme 2: semi-persistent CSI reporting (e.g. activate/release mechanism analogous to LTE SPS)
  - Scheme 3: aperiodic CSI reporting
  - FFS: Possible signaling support
- Strive to design NR periodic, semi-persistent, and/or aperiodic CSI reporting, considering at least following aspects
  - UL coverage
  - Required RS
  - Reporting information type
  - Forward compatibility
  - Energy efficiency
  - RS and CSI reporting overhead
- Study whether to avoid specifying dependency between CSI reports in different reporting instances
  - Such dependencies, if any, can be different for periodic, semi-persistent, and/or aperiodic CSI reporting

CSI timing

R1-168135 WF on CSI timing relationship LG, InterDigital, Intel, Huawei

Agreements:

- Study flexible timings of RS indication/transmission for CSI measurement, CSI feedback triggering/reporting. Following aspects should be considered at least for periodic CSI (where appropriate)/aperiodic/semi-persistent CSI reporting
  - Linkage between each timing
    - Details FFS. Some non-exhaustive exemplary timing relationships include:
      - Ex1) RS indication and CSI feedback triggering
      - Ex2) RS indication and RS transmission
      - Ex3) RS indication, RS transmission, CSI feedback triggering and CSI reporting in the same [SF]
  - Signaling method for timing, if needed (if so, details)
  - Feasible time gap between RS transmission and CSI reporting taking CSI computation delay/complexity, propagation delay, channel coherence time, and UL timing advance into account
  - Signaling overhead needs to be taken into account
  - Note: the timing above refers to layer 1 control signaling, higher-layer signaling or a combination thereof
    - Note: RS indication can be RS triggering or RS activation/deactivation, and can include RS resource configuration.

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– Note: This doesn't preclude a fixed timing based RS transmission for CSI measurement, CSI feedback reporting.

R1-168176 WF on RS for CSI Acquisition and Demodulation in NR Huawei, HiSilicon

R1-168498 WF on RS for CSI Acquisition and Demodulation in NR Huawei, HiSilicon

Agreements:

- At least one of following RS configurations for CSI measurement are supported in NR
  - Aperiodic RS
  - Semi-persistent RS
  - Periodic RS
- Study RS pattern for CSI measurement in NR both for DL and UL
  - Study the density of RS
  - Study the position of RS in the [subframe]
  - Study the mapping of RS in one or several symbols

R1-168308 WF on support of rotatable UE with beamforming in NR LG, Intel, KT, MediaTek, InterDigital, Samsung

Agreements:

- Study impacts of UE movement, rotation and/or channel/beam blockage w.r.t. following aspects
  - UE/TRP beam change
  - CSI mismatch from CSI reporting instance to data transmission instance
- Study at least the following techniques under the consideration of UE movement, rotation and/or channel/beam blockage including
  - Beam management of UE/TRP Tx/Rx beams
  - Transmission/reception techniques to provide more robustness (e.g. semi-OL MIMO transmission, beam cycling, beam broadening)

R1-168389 WF on the design of downlink control channel ZTE Corporation, ZTE Microelectronics, Qualcomm, ASTRI, Intel Corporation

Revision of R1-168274

Agreements:

- Study the relationship of beam(s) used for L1 control channel and beam(s) used for data channel
  - E.g. Using different beamwidth for data and control
  - E.g. Using different beam directions for data and control
  - E.g. At least one beam is shared by data and control
  - E.g., same beam for data and control

R1-168486 WF on number of antenna ports for CSI-RS Ericsson, Samsung, Verizon, Sprint, Deutsche Telekom

Agreements:

- For NR, support DL CSI measurement with X antenna ports
  - Study the values of X = 1,2,4,8,12,16,20,24,28,32
  - Study whether additional values of X are needed, including X > 32 (e.g., 64)
  - Other values of X are not precluded

R1-168318 **Summary of Wednesday Offline Session on NR MIMO** **Samsung**

Decision: The document is noted.

R1-168448 Summary of Thursday Offline Session on NR MIMO Samsung

R1-168530 WF on network coordination aspects Nokia, Samsung, Mediatek, Intel, ASB

Agreements:

- Study to support various interference management schemes:
  - Interference management over different time scales:
    - Semi-static/preconfigured interference management
    - Dynamic interference management
  - Interference management where signals/channels from/to UE(s) is
    - Transmitted from/to multiple TRPs
    - Transmitted from/to single TRP
- The above study should consider:
  - Forward compatibility, e.g., for future introduction of additional interference management schemes (if any)
  - Low and high NR frequencies
  - Take into account backhaul/fronthaul latency constraints
  - Both TDD and FDD
  - Both data and control channels
  - Interference measurement/reporting
  - Taking into account interference management for advanced receivers
  - Taking into account various scenarios
  - Taking into account beam management, different antenna structures, etc.

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R1-168536 WF on RS design principle in NR Huawei, HiSilicon

Agreements:

- NR support NR RS configured on a per UE basis
- FFS whether or not to support always-on non-UE-specific RS in NR
  - Including the details of always-on and non-UE-specific, if supported

R1-168529 WF on scenario and channel model for NR MIMO link and system level calibration ZTE Corporation, ZTE Microelectronics

The document was presented by … from …
Discussion: .
Decision: The document is noted.

R1-166109 Antenna structure: impact on MIMO transmission and remaining modeling issues Huawei, HiSilicon
R1-166211 Unified MIMO framework for NR above and below 6GHz ZTE Corporation, ZTE Microelectronics
R1-166212 Beam selection and CSI acquisition for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166213 Reference signal design for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166214 Beam management for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166215 Beamforming architecture for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166216 Views on transmission schemes for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166217 Discussion on Control Channel Design for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166218 Aperiodic CSI for NR MIMO ZTE Corporation, ZTE Microelectronics
R1-166219 NR beamforming with UE-group-specific beam sweeping ZTE Corporation, ZTE Microelectronics
R1-166220 Beamforming design considering channel charateristics of Above 6-GHz ZTE Corporation, ZTE Microelectronics
R1-166380 Uplink MIMO transmission schemes Qualcomm Incorporated
R1-166383 QCL Considerations Qualcomm Incorporated
R1-166478 MIMO transmission schemes for NR CATT
R1-166479 CSI feedback for NR MIMO CATT
R1-166480 Discussion on beam training CATT
R1-166481 Reference signal design for NR MIMO CATT
R1-166482 Initial evaluation results for NR MIMO CATT
R1-166561 Beamforming for NR PDCCH Intel Corporation
R1-166563 On the need of new QCL parameters in NR Intel Corporation
R1-166564 Discussion on possible QCL and measurement assumptions for NR Intel Corporation
R1-166565 Beam management without prior beam information Intel Corporation, Verizon Wireless
R1-166566 Beam management with prior beam information Intel Corporation, Verizon Wireless
R1-166567 UE beamforming impact on control channel design Intel Corporation
R1-166573 Maximum number of multiplexed layers for NR MIMO Mitsubishi Electric Co.
R1-166574 Nonlinear precoding schemes for NR MU-MIMO Mitsubishi Electric Co.
R1-166582 Application of compressive sensing based beam training for NR Beijing Xinwei Telecom Techn.
R1-166583 Considerations on Beam Management for NR Beijing Xinwei Telecom Techn.
R1-166584 Considerations on Multi-antenna Schemes for NR Control Channel Design Beijing Xinwei Telecom Techn.
R1-166585 Multi-antenna related considerations on Initial Access Beijing Xinwei Telecom Techn.
R1-166611 Discussion on analog beamforming for NR MIMO Guangdong OPPO Mobile Telecom.
R1-166612 DL PHY procedure issues for multi-beam based approaches Guangdong OPPO Mobile Telecom.
R1-166657 Views on beam management for NR Sony
R1-166677 Discussion on CSI Acquisition for Massive MIMO in NR Fujitsu
R1-166778 Discussions on CSI-RS design for NR MIMO Samsung
R1-166779 Discussions on CSI reporting for NR Samsung
R1-166780 Discussions on channel and interference measurements for NR Samsung
R1-166781 DL MIMO for NR Samsung
R1-166782 UL MIMO for NR Samsung
R1-166783 Advanced CSI feedback for NR Samsung
R1-166784 Simulation results for explicit CSI feedback for NR MIMO Samsung
R1-166785 Discussion on TRP beamforming and beam management Samsung
R1-166786 Discussion on CSI acquisition for multi-beam based approaches Samsung
R1-166787 Discussion on the antenna port and QCL assumption study in NR Samsung
R1-166789 Analog/digital/hybrid beamforming for massive MIMO Samsung
R1-166790 Discussion on paging in NR - Multi-beam aspects Samsung
R1-166791 Discussion on interference management based on advanced transceivers for NR Samsung
R1-166793 Discussion on interference coordination for NR Samsung

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R1-166900 Views on NR MIMO design principle LG Electronics
R1-166901 Discussion on CSI-RS design and CSI procedure for NR LG Electronics
R1-166902 Discussion on reciprocity based transmission for NR MIMO LG Electronics
R1-166903 Discussion on transmit beam coordination and QCL for NR LG Electronics
R1-166904 Discussion on the impact of UE rotation LG Electronics
R1-166905 Discussion on Semi-OL MIMO for NR LG Electronics
R1-166906 Consideration on UL sounding signal design for NR LG Electronics
R1-166907 DMRS Design Issues in NR LG Electronics
R1-166908 Discussion on Performance Evaluation for NR DMRS LG Electronics
R1-166909 Discussion on Common Phase Error Compensation for above 6GHz LG Electronics
R1-166943 Discussion on CSI acquisition framework for NR ETRI
R1-167078 Massive MIMO: Channel State Information (CSI) Acquisition in Angular Domain Sony
R1-167111 CSI acquisition framework for NR MIMO CMCC
R1-167112 Initial System Level Evaluation for NR MIMO CMCC
R1-167128 Discussion on UL beam management in multi-beam operation Intel Corporation
R1-167129 Discussion on CSI feedback for NRIntel Corporation
R1-167130 Evaluation results of NR for above 6GHz Intel Corporation
R1-167197 CSI acquisition mechanism for NR DL MIMO Huawei, HiSilicon
R1-167198 Discussion on transmission schemes for NR DL MIMO Huawei, HiSilicon
R1-167199 Evaluation of the impact of QCL assumptions and discussion on potential QCL configurations Huawei, HiSilicon
R1-167208 Discussion on NR UL MIMO Huawei, HiSilicon
R1-167224 Principles for Reference Signal Design and QCL Assumptions for NR Huawei, HiSilicon
R1-167225 Interference Measurement Mechanism for Link Adaptation in NR Huawei, HiSilicon
R1-167226 Uplink Power Control Huawei, HiSilicon
R1-167279 On the UE beamforming in new radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167280 Multi-Beam Common Control Plane Design Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-167281 Scalability of MIMO operation across NR carrier frequencies Nokia, Alcatel-Lucent Shanghai Bell
R1-167282 Channel reciprocity support in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167283 Coverage Enhancement Opportunities at High Carrier Frequencies Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless
R1-167284 CSI feedback mechanisms for multi antenna operation Nokia, Alcatel-Lucent Shanghai Bell
R1-167285 Unified MIMO transmission mode for 5G new radio interface Nokia, Alcatel-Lucent Shanghai Bell
R1-167286 Beam management procedures in beam based access Nokia, Alcatel-Lucent Shanghai Bell
R1-167287 On procedures for beam selection and feedback signalling Nokia, Alcatel-Lucent Shanghai Bell
R1-167288 On beam training based on periodic DL signals Nokia, Alcatel-Lucent Shanghai Bell
R1-167290 Reference symbols types in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167292 Power control for MIMO Nokia, Alcatel-Lucent Shanghai Bell
R1-167293 Downlink network coordination for New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167332 Beam-based design framework for New Radio INTERDIGITAL COMMUNICATIONS
R1-167380 Multi-Antenna based Coverage Enhancement NTT DOCOMO, INC.
R1-167381 CSI acquisition schemes for NR NTT DOCOMO, INC.
R1-167382 RS structure for NR downlink transmission NTT DOCOMO, INC.
R1-167383 Simulation results for UE beamforming NTT DOCOMO, INC.
R1-167384 Initial Performance Investigation of Hybrid Beamforming NTT DOCOMO, INC.
R1-167385 TDD massive MIMO for NR NTT DOCOMO, INC.
R1-167386 Discussion on CSI acquisition scheme for Uplink MIMO transmission NTT DOCOMO, INC.
R1-167460 Overview of CSI framework for NR Ericsson
R1-167461 Dynamic CSI framework Ericsson
R1-167462 Unified CSI reporting framework Ericsson
R1-167463 Pooling of RS resources for CSI reporting Ericsson
R1-167464 General aspects of spatial multiplexing for NR Ericsson
R1-167465 Multi antenna transmisssion principles for data channels in NR Ericsson
R1-167467 Reference signals and reports to support beam management Ericsson
R1-167468 On DL RS for CSI measurements Ericsson
R1-167469 On UL RS for CSI measurements Ericsson
R1-167470 Multi-antenna aspects for DMRS design Ericsson
R1-167471 Discussion of multi-antenna and highly directional beam-forming for unlicensed operation Ericsson
R1-167519 Discussion on hybrid beamforming Lenovo
R1-167520 Comparison of beam-selection and PMI-based schemes for NR MIMO Lenovo
R1-167525 Beam Sweeping Design Issues in NR MediaTek Inc.
R1-167543 Beam Management Considerations for above 6GHz NR MediaTek Inc.
R1-167548 Discussion on NR beam identification information design ITRI
R1-167571 On UL channel reciprocity for NR InterDigital Communications

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R1-167572	On CSI feedback for NR	InterDigital Communications
R1-167573	Considerations on Reference Signal Design for NR	InterDigital Communications
R1-167585	Over the Air Reciprocity Calibration and Compensation in NR MIMO	National Instruments Corp.
R1-167756	UL power control in multi-beam based approaches	ASUSTEK COMPUTER (SHANGHAI)
R1-167822	On multi-antenna schemes for New Radio	CEWiT
R1-167827	Considerations on multi-antenna scheme design for NR	China Unicom
R1-167887	Discussion on spatial multiplexing for NR	Samsung
R1-167888	Study of phase noise tracking	Intel Corporation
R1-167903	Evaluation methodology and assumptions for NR MIMO	ZTE Corporation, ZTE Microelectronics
R1-167948	WF on RS for CSI acquisition and demodulation in NR	Huawei, HiSilicon
R1-167952	WF on network coordination aspects	Nokia
R1-167970	WF on the antenna ports QCL in NR	Intel, LGE
R1-167997	WF on frequency selective precoding for NR UL MIMO	Samsung, Intel
R1-168134	WF on support of rotatable UE with beamforming in NR	LGE
R1-168135	WF on CSI timing relationship	LGE
R1-168175	WF on RS for beam management	Huawei
R1-168176	WF on RS for CSI acquisition and demodulation in NR	Huawei
R1-168177	WF on ULMIMO transmission	Huawei
R1-168180	WF on QCL assumptions in NR	Huawei
R1-168185	WF on aperiodic beam sweeping and CSI reporting	ZTE
R1-168186	WF on periodic and semi-persistent CSI for NR	Samsung, Ericsson, Qualcomm

8.1.6 Aspects related to initial access and mobility

Discuss PHY layer aspects related to initial access and mobility, considering beamforming aspects, for standalone and non-standalone operation

R1-167055 Overview on initial access and mobility Ericsson

The document was presented by Asbjorn Grovlen from Ericsson.

- Proposal 1: The initial time synchronization is provided by the Synchronization Signal(synchronization signal) where identical synchronization signal can be transmitted by multiple transmission points.
- Proposal 2: Target 100 ms periodicity for the synchronization signal and system information to limit the always-on signals for forward compatibility and lower energy consumption.
- Proposal 3: Idle-mode mobility measurements are based on the synchronization signals used for initial access.
- Proposal 4: Connected mode mobility measurements are based on specific reference signal unrelated to the synchronization signals used for initial access and idle mode mobility.
- Proposal 5: The reference signals for connected mode mobility can be configured that can be configured on a per-need basis

Decision: The document is noted.

R1-167294 Basic Principles for Initial Access and Mobility Nokia, Alcatel-Lucent Shanghai Bell, Verizon Wireless

The document was presented by Mihai Enescu from Nokia.

- Proposal 1: Periodic synchronization signal(s) are needed for initial search and synchronization.
- Proposal 2: Signal structure used for initial search signal should be common both in single-beam and multi-beam operation.
- Proposal 3: Default numerology is used for synchronization signals (per frequency band).
- Observation 1: Tens to hundreds of beams per cell which needs to be uniquely identifiable by the UEs.
- Observation 2: Hierarchical beam identification structure is needed.
- Observation 3: Synchronization signal needed for beam synchronization.
- Observation 4: Synchronization signal can convey ID that is used as basis to derive beam reference signal for the cell.
- Proposal 4: Physical broadcast channel needs to be defined to deliver essential system information.
- Proposal 5: PBCH should support both single-beam and multi-beam operation.
- Proposal 6: Random access procedure should support both single-beam and multi-beam operation.
- Proposal 7: Default numerology applied for the signals and channels in random access procedure.
- Proposal 8: Periodical downlink beam reference signals are basis for downlink based mobility.
- Proposal 9: Define a periodical discovery signal comprising synchronization signal(s), beam reference signals and physical broadcast channel transmitted by a cell.
- Observation 6: UL signal for UL based mobility may be used triggering downlink mobility measurements.
- Observation 7: UL based mobility likely more feasible at lower carrier frequencies than higher carrier frequencies where UE uses directional transmissions instead of omni-directional.

Decision: The document is noted.

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R1-167912 Discussion on initial access and mobility for NR NTT DOCOMO, INC.

The document was presented by Hiroki Harada from NTT DOCOMO.

- Proposal 1: RAN1 should study synchronization signal (SS) design for eMBB/URLLC.
  - Different design of SS for mMTC can be considered and introduced (if necessary) later.
- Proposal 2: NR should support multiple SS numerologies for different frequency bands and different synchronization accuracy requirements.
- Proposal 3: NR should support both single-beam based and multi-beam based approaches for SS transmission.
  - Target number of beams for SS transmission and corresponding resource mapping design should be studied.
- Observation 1: SS transmission periodicity for standalone NR carrier should be short (e.g., 5 or 10 ms) while SS transmission periodicity for non-standalone NR carrier can be longer (including possibility of no transmission) by using assistance from other NR or LTE carrier.
- Proposal 4: Only essential system information required for standalone initial access is transmitted in MIB (and SIB) as always-on signal and other system information can be provided on-demand after random access.
- Proposal 5: Design of identity parameter used for SS generation and MIB decoding should not limit NR deployment flexibility.
- Proposal 6: DL-based measurement should be assumed as baseline for UE controlled mobility.

Decision: The document is noted.

R1-167944 WF on NR initial access NTT DOCOMO, Nokia, ASB, Ericsson

The document was presented by Hiroki Harada from NTT DOCOMO.

- RAN1 should strive for a common framework, including for example structure of synchronization signals, for initial access
- More specifically, especially within a given frequency range, RAN1 should strive for a common framework covering
  - Single beam based and multi-beam based deployments
  - TDD and FDD operations
  - Different/mixed numerologies
  - Standalone and non-standalone operations
  - Licensed band and unlicensed band operations
- RAN1 should take following requirements into account to design synchronization signal(s) and essential system information for initial access
  - Providing at least following functionalities
    - Detection of NR cell and its ID
    - Initial time/frequency synchronization to the cell
    - Providing necessary information for random access
  - Providing sufficient number of identity parameters to allow deployment flexibility

Decision: The document is noted and modified as follows:

Agreements:

- RAN1 should strive for a common framework, including for example structure of synchronization signals, for initial access
- More specifically, especially within a group of frequency bands in the frequency range, RAN1 should strive for an unified framework covering
  - Single beam based and multi-beam based deployments
  - TDD and FDD operations
  - Different/mixed numerologies
  - Standalone and non-standalone operations
  - Licensed band and unlicensed band operations
  - FFS: mMTC use case
- RAN1 should take at least following requirements into account to design initial access
  - Providing at least following functionalities
    - Detection of NR cell and its ID
      - Note: In this context, NR cell corresponds one or multiple TRP(s)
    - Initial time/frequency synchronization to the cell
    - Providing necessary information for random access
  - Providing sufficient number of the identity values to allow deployment flexibility
  - FFS: supporting efficient mobility
  - FFS: supporting efficient inter-RAT measurement
  - Reducing the frequency hypothesis UE needs to search for compared to LTE
  - FFS: detecting beam ID(s)

R1-167957 WF on evaluation assumptions for initial access in NR Intel Corporation

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The document was presented by Gregory Morozov from Intel.
Discussion: Huawei requested more time for detailed review.
Decision: The document is noted. Continue offline discussion until Tuesday – (Intel)
Tuesday: Evaluation assumptions have been revised in R1-168107 and agreed in R1-168162.
Continue offline discussion until Wednesday – (Intel)
Wednesday: Evaluation assumptions have been revised in R1-168239 , all brackets removed and agreed in R1-168255 by adding the following note in PHY abstraction: "Proponents are allowed to provide PHY abstraction details if used"
Note that R1-168255 superseeds the previously agreed R1-168162.

R1-168481 WF on evaluation assumptions for initial access in NR Intel
Agreed in R1-168493 with following updates in channel model
· CDL-C for 4 and 30GHz, CDL-D for 70 GHz (other CDL models are not precluded),

RACH procedure
R1-168124 **WF on RACH procedure for NR NTT DOCOMO, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell**
The document was presented by Kazuaki Takeda from NTT DOCOMO.
- RACH procedure including RACH preamble (Msg. 1), random access response (Msg. 2), message 3, and message 4 is at least assumed for NR from RAN1 perspective
- Simplified RACH procedure, e.g., Msg. 1 (UL) and Msg. 2 (DL), should be further studied
  - Details on Msg. 1 and Msg. 2 are FFS
- The design of the random access procedure should take into account the possible use of multi-beam DL and multi-beam UL as well as multi-beam DL and single-beam UL
- In case that beam-forming is applied to DL broadcast channels/signals for initial access, association between DL broadcast channels/signals detected by UE for initial access and RACH resource is considered.
  - FFS: Details on association in the context of multi-beam DL - multi-beam UL and multi-beam DL - single-beam UL
- Multiple occasions for RACH preamble transmission in a given time interval is supported
  - FFS: Details on time interval
- Allow for RACH reception/RAR transmission in TRPs other than the one transmitting synchronization signals

Decision: The document is noted. Continue offline discussion until Wednesday – (NTT DOCOMO)

R1-168104 **WF on NR multi beam initial access ZTE**
The document was presented by Patrick Svedman from ZTE.
- RAN1 should study multi-beam based approaches to enable beamforming gain in each initial access step, considering:
  - Non Rx/Tx reciprocity at BS or UE
  - Full or partial Rx/Tx reciprocity at BS or UE
- RAN1 should strive for a unified initial access framework for different reciprocity cases.

Discussion: Also supported by InterDigital.
Decision: The document is noted. Continue offline discussion until Wednesday – (ZTE)

R1-168260 **WF on RACH procedure for NR NTT DOCOMO, ZTE, CATT, Samsung**
Decision: The document is noted.

Agreements:
- RACH procedure including RACH preamble (Msg. 1), random access response (Msg. 2), message 3, and message 4 is at least assumed for NR from RAN1 perspective
- Simplified RACH procedure, e.g., Msg. 1 (UL) and Msg. 2 (DL), should be further studied
  - Details on Msg. 1 and Msg. 2 are FFS
  - Study should include comparison with the above procedure (first bullet)
- The design of the random access procedure should take into account the possible use of single-beam and multiple beam operations, including
  - Non Rx/Tx reciprocity at BS or UE
  - Full or partial Rx/Tx reciprocity at BS or UE
- In case that multiple beam-forming is applied to DL broadcast channels/signals for initial access,
  - RACH resource is obtained by UE from detected DL broadcast channels/signals
    - FFS: Details on association
  - Other mechanism w/o association is also considered
- Multiple occasions for RACH preamble transmission in a given time interval are considered
  - Details are FFS
  - Other mechanism is not precluded
- Study further RACH reception/RAR transmission in TRPs/beams other than the one transmitting synchronization signals

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About RACH, continue offline discussion until Thursday focusing on evaluation assumptions and signal design – Patrick (ZTE), Kazuaki, (DOCOMO), Seunghee (Intel), Hyunseok (Samsung)

R1-168390 WF on Link Level Evaluation Assumptions for RACH Preamble NTT DOCOMO
Agreed in R1-168492 with following updates in channel model
· CDL-C for 4 and 30GHz, CDL-D for 70 GHz (other CDL models are not precluded),

R1-168127 **WF on RRM measurement in NR LG Electronics, NTT DoCoMo**
- For RRM measurement in NR, DL measurement is supported at least for idle mode UE with the consideration on
  - Both single-beam based operation and multi-beam operation
- FFS: Definition of RRM measurement for multi-beam based operation
- FFS: DL signal for RRM measurement in idle mode

Decision: The document is noted.

R1-166393 High speed mobility performance evaluations Qualcomm Incorporated
- Observation 1: For RRC inactive state, in mobility challenging scenario, DL based mobility can have high paging miss probability
- Observation 2: For RRC inactive state, in mobility challenging scenario, paging missing probability for DL based mobility can be improved at the expense of UE power consumption increase, e.g. more frequent and longer cell-search
- Observation 3: For RRC inactive state, in mobility challenging scenario, UL based mobility can still provide reliable paging because of fast closed-loop L1 handshake at each DRX wakeup (i.e., UE transmitting a reference signal and Network sending back a response signal)
- Observation 4: For RRC inactive state, in mobility challenging scenario, UL based mobility can provide better paging reliability and UE power consumption tradeoff, compared to DL based mobility
- Our proposals are as follows
- Proposal 1: NR shall support UL-based mobility in which UE transmits reference signals and RAN determines a mobility event based on measurements of reference signals of UE's.
- Proposal 2: NR shall consider supporting hybrid/dynamic DL-based and UL-based mobility
- Proposal 3: Evaluate mobility performance. Following are the proposed KPIs.
  - RRC inactive state (similar to LTE_IDLE)
    - Paging-miss rate
    - Call-setup delay (i.e., number of consecutive Network paging miss before UE establishes a connection)
    - Network paging resource utilization (e.g., number of TRPs involved in paging a UE)
    - UE (intra-frequency) cell-search rate (relates to UE power consumption.)
    - Comparative UE power consumption analysis
  - RRC connected state (similar to LTE RRC_CONNECTED)
    - Handover-failure rate
    - Mobility interruption time
    - User experience during the HO

Decision: The document is noted.

Agreements (made on Wednesday further to offline discussions refining R1-168127):
- For RRM measurement in NR, at least DL measurement is supported with the consideration on
  - Both single-beam based operation and multi-beam based operation
- FFS: Definition of RRM measurement for multi-beam based operation
- FFS: DL signal for RRM measurement
- FFS: When DL measurement is applied
- Note that there is no conclusion that DL measurement is a complete solution for RRM measurement in NR for now

R1-168137 **WF on RRM Measurement and Mobility Huawei, HiSilicon, Qualcomm**
- For RRM measurement and mobility in NR, the following should be supported:
  - UL measurement can be used for:
    - L1/L2 based intra NR cell TRP mobility
    - L3 based inter NR cell mobility
  - UL signals used for UL measurement includes:
    - At least an energy-efficient UE-specific UL tracking signals
  - DL measurement can be used for
    - intra NR cell TRP mobility and DL beam management
    - NR cell reselection

  Note: In this context, NR cell corresponds to one or multiple TRP(s)

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Decision: The document is noted.

Conclusions:

- For RRM measurement and mobility in NR, RAN1 needs to study DL and UL based measurements considering following RAN2 study
  - RRC driven at 'cell' level
  - Zero/Minimum RRC involvement (e.g. at MAC /PHY)
  - FFS what is the definition of a cell

Continue offline discussion about the detailed evaluation assumptions until Wednesday – David (Huawei), Tingfang (Qualcomm)

R1-168464 Evaluation Scenarios and Assumptions for DL and UL Mobility Qualcomm, Huawei
R1-168488 Evaluation Scenarios and Assumptions for DL and UL Mobility Qualcomm Incorporated, Huawei, Intel

R1-166387 **Uplink based mobility physical channels Qualcomm Incorporated**
Decision: The document is noted.

R1-167059 **On the random access procedure Ericsson**
The document was presented by Asbjorn Grovlen from Ericsson.

- Proposal 1: NR should support a four message random access procedure in order to support larger distances between UE and TRP
- Proposal 2: Study additional two step random access procedure to reduce the delay of accessing the network
- Proposal 3: If synchronization signals are beamformed, an association between SS and PRACH preambles should be supported.

Decision: The document is noted.

R1-167378 **RACH procedures for NR NTT DOCOMO, INC.**
The document was presented by Hiroki Harada from NTT DOCOMO.

- Proposal 1: The RACH procedure involving a transmission/reception of RACH preamble, RAR, message 3 and message 4 is at least supported for NR.
- Proposal 2: The simplified RACH procedure including only RACH preamble (and UL control channel/data) and RAR should be further considered.
- Proposal 3: Association between RACH resource and beam index should be considered to support efficient multi-beam operation for RACH procedure.

Decision: The document is noted.

R1-166799 **Random access in NR considering flexible UE channel bandwidth Samsung**
The document was presented by … from Samsung.

- Requirements to support different UE bandwidths on the same NR carrier
  - In order to support UEs with different bandwidth capabilities on the same NR carrier, PRACH bandwidth should be larger than or equal to minimum supported UE bandwidth.
  - The NR-PDCCH for RAR and RAR should be transmitted by NR-BS over bandwidth less than or equal to channel bandwidth of UE.
  - The NR-PDCCH for MSG3 retransmission should be transmitted by NR-BS over bandwidth less than or equal to channel bandwidth of UE. Resources for MSG3 transmission should be allocated to UE over bandwidth less than or equal to channel bandwidth of UE.
  - The NR-PDCCH for MSG4 (re)transmissions should be transmitted by NR-BS over bandwidth less than or equal to channel bandwidth of UE. Resources for MSG4 transmission should be allocated to UE over bandwidth less than or equal to channel bandwidth of UE.
- Proposal: The RACH-related signals and channels should be designed to take a benefit from various bandwidth values that NR UEs may support.

Decision: The document is noted.

Wednesday

R1-166795 **Discussion on numerology aspects of NR synchronization signal Samsung**
Decision: The document is noted. Continue offline discussion about SS numerology – Samsung
R1-168277 WF on numerology for synchronization signals in NR Samsung, ETRI, CATT, NTT DOCOMO, Ericsson
Agreements:

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- For subcarrier spacing of each synchronization signal (e.g. NR PSS,SSS) in a NR carrier, the following alternatives should be studied
  - Alt 1: Subcarrier spacing is predefined in the specification for a given frequency range
    - Ex: 15kHz for sub-6GHz, 60kHz for over-6GHz
    - Note that there are more than one frequency ranges
  - Alt 2: Subcarrier spacing is selected by NR BS
    - FFS: Details on the set of possible numerologies
    - Note: Blind detection of multiple numerologies can be considered
  - Alt 3: Single subcarrier spacing is predefined in the specification for all frequency ranges
  - Other alternatives are not precluded
- NR synchronization signal is based on CP-OFDM
  - Note that DFT-spread-OFDM based design is not precluded

R1-168091 WF on carrier bandwidth for initial access in NR Mediatek

- The synchronization channel and at least some essential system information are restricted within a certain specified bandwidth.
  - The specified bandwidth may depend on the range of the frequency bands.
  - The specified bandwidth is not larger than the minimum system bandwidth to be supported in the corresponding frequency bands
  - e.g., the specified bandwidth can be 5MHz, 20Mhz, 80Mhz depending on the range of frequency bands.
- FFS: mMTC case
- FFS: uplink bandwidth for RACH.

Decision: The document is noted. Continue offline discussion within Wednesday

Wednesday

R1-168299 WF on carrier bandwidth for initial access in NR MediaTek, SierraWirless

- The synchronization channel and at least some essential system information are restricted within a set of specified frequency resources.
- A set of specified frequency resources may depend on the range of the frequency bands and the numerology.
  - FFS: a set of frequency resources
- FFS: whether the used frequency resource is blindly detected by UE from a set of specified frequency resources or set by default according to the frequency bands.

Discussion: FFS: uplink bandwidth for RACH.

Decision: The document is noted. Continue offline discussion until Thursday

R1-168397 WF on carrier bandwidth for initial access in NR MediaTek,
R1-168483 WF on carrier bandwidth for initial access in NR MediaTek, Intel

Agreements:

- At least one transmission bandwidth within a carrier bandwidth can be specified for transmission of each synchronization signal and at least some essential system information.
  - The transmission bandwidth may be specified either differently according to the frequency range or the same across the frequency ranges
  - FFS: transmission bandwidths for each synchronization signal and at least some system information are same or not
  - FFS: the transmission bandwidth and the corresponding numerology
  - FFS: whether the used transmission bandwidth is blindly detected by UE from specified bandwidths according to the frequency bands

R1-168463 Way forward on initial access for NR LG Electronics, NTT DOCOMO
Also supported by Mitsubishi, ZTE
R1-168512 Way forward on initial access for NR LG Electronics, NTT DOCOMO, Panasonic, ETRI

Agreements:

- In order for the transmission of the information required for the initial access (e.g. configuration of random access resource), at least following options are to be studied:
  - Note: the above information can consist of multiple parts, and different option below can be applied for the transmission of each part
  - Opt 1: the transmission is scheduled by dynamic signaling (e.g. control channel)
  - Opt 2: the transmission is scheduled by semi-static signaling (e.g. via the previous part)
  - Opt 3: the transmission is done alone without associated signaling (e.g. predefined in spec)
- In the above study, at least following aspects should be considered:
  - Resource flexibility (e.g. in terms of ensuring forward compatibility, dynamic TDD operation)
  - Resource overhead

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– UE complexity (e.g. involved with decoding of the information)

R1-168494 WF on sync and carrier rasters Huawei, HiSilicon, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell, NTT Docomo, Ericsson, ETRI, InterDigital

Email approval until 1st September to tell the current RAN1 agreements and WA to RAN2

The document was presented by … from …
Discussion: .
Decision: The document is noted.

R1-166088 Access mechanism for beam based approach Huawei, HiSilicon
R1-166107 Synchronization and initial access mechanism in NR Huawei, HiSilicon
R1-166114 Low frequency assisted high frequency operation Huawei, HiSilicon
R1-166222 Evaluation and analysis on coverage issue of initial access for NR above 6GHz ZTE Corporation, ZTE Microelectronics
R1-166228 Beam control operation for common channels/signals in NR Mitsubishi Electric Co.
R1-166384 Initial access consideration for mmW Qualcomm Incorporated
R1-166385 Initial access consideration for NR sub6GHz Qualcomm Incorporated
R1-166386 DL and UL based mobility procedures Qualcomm Incorporated
R1-166389 Beam management for NR Qualcomm Incorporated
R1-166417 Overview of NR initial access ZTE
R1-166418 Design considerations for DL sweeping time interval in NR ZTE
R1-166419 Beamformed random access in NR ZTE
R1-166420 Performance analysis of cell search in NR ZTE
R1-166421 Multi-TRP aspects of random access ZTE
R1-166422 Unified synchronization structure ZTE
R1-166483 NR Initial Access and Mobility Management CATT
R1-166586 Considerations on Initial Access Design Beijing Xinwei Telecom Techn.
R1-166639 Discussion on initial access and mobility for NR standalone cell NEC
R1-166653 Consideration on synchronization for NR Sony
R1-166658 On RRM measurement for NR Sony
R1-166678 Discussion on initial access in NR Fujitsu
R1-166794 Network topology and system operation for NR Samsung
R1-166796 Overview on issues for NR initial access Samsung
R1-166797 Coverage enhancement of broadcasting channels/signals Samsung
R1-166798 PHY initial access procedure for multi-/single-beam based approaches Samsung
R1-166910 Discussion on DL Synchronization in NR LG Electronics
R1-166911 Discussion on PRACH preamble design and RACH procedure for NR LG Electronics
R1-166912 Discussion on Coverage Enhancement with Multi-beam LG Electronics
R1-166913 RRM measurement and beam procedure in NR LG Electronics
R1-166944 Band-agnostic initial access for NR ETRI
R1-166945 Aspects related to RRM measurements ETRI
R1-166946 Aspects related to system informations ETRI
R1-166947 Beam sweeping for initial access ETRI
R1-166948 Transmission of synchronization signal on demand ETRI
R1-166949 Band-agnostic synchronization and cell search ETRI
R1-167028 Sync and beam acquisition procedure in multi-beam based approach KT Corp.
R1-167056 Idle mode operation and initial access Ericsson
R1-167057 Connected mode mobility Ericsson
R1-167058 On PRACH preamble design Ericsson
R1-167060 On NR random-access response design Ericsson
R1-167113 Link level evaluation for single-beam based and multi-beam based initial access CMCC
R1-167114 Gradual UE-Specific (GUS) initial access and multi-beam-based mobility management CMCC
R1-167115 Discussion on beam sweeping for Initial Access CMCC
R1-167200 RRM Measurement for NR Huawei, HiSilicon
R1-167205 UE-cell-center-like design principles and tracking signal design Huawei, HiSilicon
R1-167217 A common synchronization signal for a NR carrier supporting different numerologies Huawei, HiSilicon
R1-167222 Discussion on Multiple Access and Channel Multiplexing for High Frequency Huawei, HiSilicon
R1-167295 Radio resource management in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167296 Random access principles for New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167333 Random access aspects for beam-based NR initial access INTERDIGITAL COMMUNICATIONS

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R1-167377 Design for RACH preamble for NR NTT DOCOMO, INC.
R1-167526 Considerations for Synchronization Signals Design in NR Beamformed Initial Access MediaTek Inc.
R1-167542 Discussion on initial access for NR MediaTek Inc.
R1-167574 On beam-based initial access for NR InterDigital Communications
R1-167631 Cell detection and mobility measurement in NR Motorola Mobility
R1-167672 Synchronization in NR considering beam sweeping ASUSTEK COMPUTER (SHANGHAI)
R1-167704 On NR Initial Access and Mobility Intel Corporation
R1-167705 Design on NR DL Synchronization Intel Corporation
R1-167706 Simulation assumptions and scenarios for NR initial access Intel Corporation
R1-167707 Initial performance evaluation of different beamforming options for NR synchronization signals Intel Corporation
R1-167741 Discussion on System Information Acquisition III
R1-167772 Localization-Assisted Mobility Support for NR Vehicular Communication National Taiwan University
R1-167801 Discussion on reference signal design for HF-NR National Taiwan University
R1-167840 Discussion on Beamforming Initial Access Operations Convida Wireless LLC
R1-167847 Discussion on Sync Signals Supporting Different Numerologies Convida Wireless LLC
R1-167912 Discussion on initial access and mobility for NR NTT DOCOMO, INC.
R1-167944 WF on NR initial access NTT DOCOMO, Nokia, ASB, Ericsson
R1-167957 WF on evaluation assumptions for initial access in NR Intel Corporation
R1-168091 WF on carrier bandwidth for initial access in NR MediaTek Inc.
R1-168107 WF on evaluation assumptions for initial access in NR Intel Corporation
R1-168127 WF on RRM measurement in NR LG Electronics, NTT DoCoMo
R1-168162 WF on evaluation assumptions for initial access in NR Intel Corporation

8.1.7 Remaining details on evaluation and scenarios for new radio interface

Focus on general evaluation assumptions and scenarios including newly introduced scenarios, e.g., satellite, air-to-ground communications. Discuss other evaluation assumptions related to each technique under each A.I.

R1-168419 Chairman's notes of AI 8.1.7 on remaining details on evaluation and scenarios for NR Ad-Hoc chair (Qualcomm)

Endorsed with following updates

R1-166112 Simulation assumptions on URLLC Huawei, HiSilicon
R1-166398 URLLC system level simulation assumptions Qualcomm Incorporated
R1-166484 Discussions on KPI and evaluation configuration for URLLC CATT
R1-167298 Remaining details on URLLC assumptions Nokia, Alcatel-Lucent Shanghai Bell

R1-166394 mMTC system level simulation assumptions Qualcomm Incorporated
R1-167539 Discussion on the channel model for mMTC SLS evaluation MediaTek Inc.

R1-166396 Extreme long range evaluation assumptions and methodologies Qualcomm Incorporated
R1-166599 Measurements of Extreme Rural Scenarios Telstra Corporation Limited

R1-166915 High level view on the study for eV2X LG Electronics
R1-166916 Remaining issues on the evaluation assumptions for eV2X LG Electronics
R1-167942 WF on coexistence between NR sidelink and LTE sidelink LG Electronics, Huawei, HiSilicon, Deutsche Telekom
Conclusion:
- This topic as in R1-167942 is to be revisited next meeting (after V2V WI, expected to be finished this meeting)

R1-167943 WF on remaining evaluation assumptions for eV2X LG Electronics, Deutsche Telekom, Huawei, HiSilicon
Proposal:
- The performance metric agreed in the email discussion [85-15] is captured in TR38.802
- The specific numbers of traffic model, inter-RSU distance, and UE distribution are by the agreed values in the TR 38.913. These values can be further updated modified, after SA1 input.
- Following the agreement in the SLS evaluation assumptions of rural and urban macro, [TBD for TDD] is removed in BS Tx power part for SLS evaluation assumptions of eV2X
- For the in-band emission modeling, RAN1 needs to study the impact of in-band emission and proper modeling for it for NR sidelink operations.
- For the LLS evaluation assumptions for eV2X, those in LTE V2X described in TR38.885 could be reused as start point, and updated if NR study has new proposals

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- Target frequency can be revisited

Further discussion offline

R1-167931 WF on performance metric for V2X NR Ericsson, LGE

Agreement:

- For the two alternatives as part of the RAN1#85 email discussion [85-15], the following is agreed:
  - Alt. 2: (1-Y) is the packet reception ratio calculated on a subset of UEs:
    - For one Tx packet, 1-Y is calculated by S/Z, where Z is the number of UEs in the intended set of receivers, and S is the number of UE with successful reception among Z.
      - Unicast is the special case where Z includes a single UE, where the PRR is average of packets of the unicast link

R1-167932 WF on system level simulations for V2X NR Ericsson

Proposal:

- Add 63GHz carrier frequency with 1GHz bandwidth (63-64GHz) for UE-UE and for UE-RSU [1]
- FFS UE-UE and UE-RSU channel models at 63GHz
- 40dBm e.i.r.p. Tx power limitation at 63GHz
- Revise the assumptions on RSU antenna pattern.
  - 4 antenna arrays with 2 elements each
  - The arrays point to the 4 streets in the intersection
  - Each antenna element irradiates with halfspherical uniform distribution over a 90deg azimuth angle
  - Antenna gain = 9dBi
- Slide 5 of R1-167932

Discuss further offline

R1-166110 On building material distribution modeling and indoor user ratio modeling Huawei, HiSilicon
R1-167387 Remaining details of the dense urban scenario NTT DOCOMO, INC.

Proposal: Regarding TRP dropping:

- Option 1 in Table II of R1-167387 is used for 4GHz case.
- Option 3 in Table II of R1-167387 is used for 30GHz case.
- Modelling of coverage enhancement schemes, e.g., using the multi-beam based transmission shall be considered, at least for 30 GHz case, in order to perform the macro-layer/micro-layer cell association.

Further discussion offline

R1-167553 On max EIRP values Ericsson

Agreement:

- Remove the brackets for urban macro scenario to set the EIRP limit to 78 dBm
- In dense urban scenario, set the EIRP limit to 73 dBm and 68 dBm for the macro and micro layers respectively
- In indoor open office scenarios, set the EIRP limit to 58 dBm

R1-167576 UE Transceiver Architecture and Noise Figure Assumptions for NR with Frequencies Above 6 GHz Straight Path Communications, Qorvo

R1-167876 High speed train scenario for RRH and relay at 30GHz: scenario and CDL-D descriptions Mitsubishi Electric

Revision of R1-166937

R1-167792 Battery Assumptions for NR u-blox AG, Sony
R1-166885 Evaluation assumptions for flexible duplex operation LG Electronics

R1-168125 Offline discussion summary NTT DoCoMo

Conclusion:

- The green parts in R1-168125 are endorsed
- Table A.2.1-1, 2, 3, cell E11, is endorsed with the following updates:
  - NOTE1: See Appendix for the derivation of maximum allowed EIRP (R1-164383, R1-167553).

R1-168121 Way Forward on O2I Penetration Loss Model Mix for NR Evaluation Straight Path, Ericsson, Samsung, Nokia, ASB, LGE, Huawei

Agreements:

- The following mix of O2I penetration loss models should be evaluated for high frequency for NR:
  - For Urban Micro and Urban Macro
    - Option1
      - Low loss model – 80%
      - High-loss model – 20%

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- Option2
  - Low loss model – 50%
  - High-loss model – 50%
- Other mix ratio(s) is not precluded.

R1-168053 WF on scenarios and evaluation assumptions for flexible duplex LG Electronics, Huawei, HiSilicon

Agreement:

- The WF in R1-168053 is agreed, with the following updates:
  - Channel model:
    - Current entries are used as a starting point
    - Can further discussion whether or not to update the channel model
  - Traffic model
    - Add optional DL/UL ratio of 1:1
    - Add one more packet size of 2Mbtyes
    - Add "other FTP model is not precluded"
  - UE receive noise figure:
    - Update according to last meeting's agreements on the noise figures (i.e., 10dB vs. 13dB)
  - Layout
    - Add: FFS other cluster dropping models for dense Urban

R1-168391 Offline dicussion updated sumary of evaluation assumptions for NR NTT DOCOMO, INC.

Agreements:

- The green entries in the attached spreadsheet in R1-168391 are agreed

R1-168371 WF on URLLC evaluation parameter and LLS method Huawei

Agreements:

- Slide 3 and slide 4 in R1-168371 are agreed
- Slide 5 in R1-168371 is agreed, with the following updates:
  - From "Companies report delay assumption, e.g., processing delay, transmission delay, re-transmission delay."
  - To "Companies report delay assumptions according to Table 1 in R1-166485". For calibration purpose only, the entries 1.1 and 1.4 of the Table 1 are assumed to be zero. In addition, each company reports the max number of HARQ re-transmissions.

R1-168441 WF on URLLC Evaluation Scenarios Intel, Ericsson, Qualcomm Inc.

Agreements:

- From RAN1 perspective, the following scenarios are used as a starting point for initial URLLC evaluations
  - Indoor Hotspot scenario
  - Urban Macro scenario

R1-168343 Extreme Long Range KPI Evaluation Qualcomm Incorporated, Ericsson, Huawei

R1-168174 WF on CDL-D model for high speed train scenario at 30GHz for RRH and relay Mitsubishi Electric, ETRI, Ericsson

Agreements:

- Slide 3 in R1-168174 is agreed

R1-168398 WF on URLLC System Capacity Definition Clarification Intel, Qualcomm Inc.

Agreements:

- System level evaluation method is used for URLLC system capacity study to analyze impact from inter-cell interference, queueing and scheduling latency, multiplexing with other services
- URLLC system capacity is calculated as follows:
  - C(L, R) is the maximum offered cell load under which Y% of UEs in a cell operate with target link reliability *R* under *L* latency bound
  - X = (100 – Y) % is the percentage of UEs in outage
  - A UE in outage is defined as the UE can not meet latency L and link reliability R bound
  - Companies report their assumption on X
- Note: definition of latency L and target link reliability *R* is provided in R1-168371

R1-168372 WF on channel model issues for flexible duplex evaluation Huawei, HiSilicon, Intel

Agreements:

- Slide 2 in R1-168372 is agreed with the following update:
  The following assumption is used as starting point for flexible duplex evaluation, and further update might be made ~~after more measurements are available~~.

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R1-168373 WF on penetration issues for flexible duplex evaluation Huawei, HiSilicon, LG Electronics
Agreements:
- R1-168373 is agreed with the following update:
  The following assumption is used as starting point for flexible duplex evaluation, and further update might be made ~~after more measurements are available~~.

R1-168370 WF on Modeling Line-of-Sight Blockage for V2V Huawei, HiSilicon, Volkswagen, Ericsson, General Motors, Vodafone
Continue discussion next meeting

R1-168547 Offline dicussion further updated sumary of evaluation assumptions for NR NTT DOCOMO
Agreements:
- The green entries and F14 in the spreadsheet attached in R1-168547 are agreed.

R1-168510 WF on SLS evaluation methodologies for MA LG Electronics, ZTE, ZTE Microelectronics
Agreements:
- Slide 4 and slide 5 are agreed except the cell "packet size" and "Target packet drop rate"

Email discussion on the two options of the packet size and clarification on Target packet drop rate
as listed in R1-168510 until 9/1 – Kazuaki (DOCOMO)
R1-168485 Battery Lifetime Model for NR Sony, u-blox, Sierra Wireless
Email discussion on battery lifetime model in R1-168485 until next meeting – Martin (SONY)
Traffic model for urban coverage for massive connection (UL) (column I and row 21 in the excel sheet) was also discussed based on the draft papers. However, no consensus has been reached on.
Email discussion on traffic model for urban coverage for massive connection (UL) (until 9/15) – Wuyong (Huawei)

R1-168517 WF on Battery Life Evaluation Methodology for mMTC Qualcomm Inc.
Discuss discussion next meeting

R1-168543 Pathloss calibration between companies Qualcomm Inc.
Email discussion for path loss calibration for 3D UMa at carrier frequency of 700 MHz until 9/9 – Haitong (Qualcomm)

R1-168473 WF on evaluation assumptions related to outdoor micro cell TRP ZTE Corporation, ZTE Microelectronics, InteI Corporation, Samsung, NTT DOCOMO

R1-168537 WF on Dense Urban Scenarios Samsung, Ericsson, Intel, Nokia, ASB, AT&T, CMCC, Softbank, Verizon, KT, Vodafone, Deutsche Telecom
Email approval until 8th September – Young-Han (Samsung)

R1-168421 WF on Indoor TRP Configuration NTT DOCOMO, CATT, Ericsson, Intel
Email discussion on R1-168421 till 9/2 – Na (DOCOMO)

R1-166113	On scenarios and evaluation method of eV2X	Huawei, HiSilicon
R1-166321	Remaining issues on assumptions related to outdoor micro cell TRP	ZTE Corporation, ZTE Microelectronics
R1-166390	Updated sub6 DL full-buffer KPI evaluation for eMBB	Qualcomm Incorporated
R1-166391	Updated sub6 UL full-buffer KPI evaluation for eMBB	Qualcomm Incorporated
R1-166392	mmW DL KPI evaluation for eMBB	Qualcomm Incorporated
R1-166393	High speed mobility performance evaluations	Qualcomm Incorporated
R1-166395	URLLC system capacity and URLLC-eMBB multiplexing efficiency analysis	Qualcomm Incorporated
R1-166397	Sub6 DL bursty traffic evaluation for eMBB	Qualcomm Incorporated
R1-166423	Evaluation assumptions for URLLC	ZTE
R1-166485	Discussions on evaluation methodology for URLLC	CATT
R1-166568	Comparison of different TRP antenna option for indoor deployment	Intel Corporation
R1-166569	Remaining issues of evaluation assumptions for URLLC	Intel Corporation
R1-166681	Traffic Model assumptions for mMTC Battery Life and Latency Evaluation	Sierra Wireless, S.A.
R1-166800	Remaining issues for URLLC evaluation assumptions	Samsung
R1-166801	TRP density and antenna modeling for indoor hotspot	Samsung
R1-166802	Dense urban evaluation assumption and results	Samsung
R1-166803	Evaluation results of dense urban on 30GHz frequency band	Samsung
R1-166885	Evaluation assumptions for flexible duplex operation	LG Electronics
R1-166914	Remaining details of evaluation assumptions for URLLC	LG Electronics
R1-166915	High level view on the study for eV2X	LG Electronics

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R1-166916 Remaining issues on the evaluation assumptions for eV2X LG Electronics
R1-166917 Evaluation results on mobility enhancement for eV2X LG Electronics
R1-167116 Quantitative metric for network energy efficiency CMCC
R1-167130 Evaluation results of NR for above 6GHz Intel Corporation
R1-167194 Evaluation result of NR for below 6GHz Intel Corporation
R1-167219 Modeling the Evolution of Line-of-Sight Blockage for V2V Channels Huawei, HiSilicon, Volkswagen
R1-167297 [85-18] PA assumptions for NR; Email discussion summary Nokia, Alcatel-Lucent Shanghai Bell
R1-167447 On KPIs for mMTC Ericsson
R1-167448 On evaluation assumptions for mMTC Ericsson
R1-167449 On battery lifetime evaluation for mMTC Ericsson
R1-167450 Measurements of extreme rural scenario Telstra, Ericsson
R1-167451 Channel model of extreme rural scenario Ericsson, Telstra
R1-167452 Path loss model of extreme rural scenario Ericsson, Telstra
R1-167453 User and traffic distribution for extreme rural scenario Ericsson, Telstra
R1-167454 Link budget for extreme rural scenario Ericsson, Telstra
R1-167455 On URLLC reliability evaluation Ericsson
R1-167456 On URLLC test cases Ericsson
R1-167457 Remaining issues on the indoor office scenario Ericsson
R1-167458 Antenna model for outdoor TRP for micro in dense urban Ericsson
R1-167459 On the use of 30 GHz in macro on all layers in dense urban scenario Ericsson
R1-167540 Remaining Issues on NR System Evaluation for mMTC MediaTek Inc.
R1-167575 URLLC KPI and evaluation assumptions InterDigital Communications
R1-167576 UE Transceiver Architecture and Noise Figure Assumptions for NR with Frequencies Above 6 GHz Straight Path Communications, Qorvo
R1-167603 Discussion on URLLC evaluation CATR
R1-167702 Discussion on channel modeling for UE-UE and BS-BS links Intel Corporation

8.1.8 Other

R1-167067 Observations on 150 ohm and way forward Ericsson
The document was presented by Stefan Parkvall and was intended introducing fun to RAN1 heavy NR session and the famous dammsugare (Swedish cookie), sweet almond chocolate gourmet.

R1-166489 NR and LTE co-existence AT&T GNS Belgium SPRL
Decision: The document is noted.
R1-166570 URLLC capacity evaluation Intel Corporation
Decision: The document is noted.
R1-167207 Sidelink Support & Enhancements for NR Huawei, HiSilicon
Decision: The document is noted.

The document was presented by … from …
Discussion: .
Decision: The document is noted.

R1-166115 Support for flexible backhauling for NR Huawei, HiSilicon
R1-166116 Support for energy efficient NR Huawei, HiSilicon
R1-166118 Support for vehicular communications in NR Huawei, HiSilicon
R1-166804 Discussion on co-existence of LTE and NR Samsung
R1-166805 Design aspects of mMTC for NR Samsung
R1-166806 Aggregation of NR Carriers Samsung
R1-166807 Shared spectrum support for NR Samsung
R1-166918 Structure of control and data multiplexing for NR LG Electronics
R1-166919 Consideration on DL control channel design for NR LG Electronics
R1-166920 Consideration on common control signaling for NR LG Electronics
R1-166921 Consideration on UL control channel design for NR LG Electronics
R1-166922 Consideration on UL power control procedure for NR LG Electronics
R1-166923 Consideration on support of CA operation for NR LG Electronics
R1-166924 On coexistence of NR and LTE LG Electronics
R1-166925 Overall discussion on mMTC LG Electronics

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R1-166990 On URLLC service characteristics Ericsson LM
R1-166991 On URLLC design Ericsson LM
R1-167061 On URLLC design principles Ericsson
R1-167062 On URLLC characteristics Ericsson
R1-167063 On channel access mechanisms for NR in unlicensed spectrum Ericsson
R1-167064 On physical Layer Design Policies for Unlicensed Operation of NR Ericsson
R1-167065 Technology components for unlicensed operation Ericsson
R1-167066 On autonomous UL transmissions for NR in unlicensed spectrum Ericsson
R1-167068 Aggregation of carriers in NR Ericsson
R1-167202 Discussion on unified duplex for unpaired spectrum - dynamic TDD Huawei, HiSilicon
R1-167221 Discussion on unified duplex for paired spectrum - flexible duplex Huawei, HiSilicon
R1-167231 Work plan for unified duplex Huawei, HiSilicon
R1-167300 Adaptive-length redundancy matching for HARQ transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-167301 HARQ enhancements for large transport block transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-167302 Early Hybrid ARQ Feedback for the 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167303 HARQ Pooling for Carrier Aggregation in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167304 On the utilization of Advanced Receivers in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-167305 On the cross-link interference mitigation Nokia, Alcatel-Lucent Shanghai Bell
R1-167306 On network energy efficiency requirement and evaluation for the 5G new radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167307 Uplink power control for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-167308 Punctured Scheduling for Low Latency Transmissions Nokia, Alcatel-Lucent Shanghai Bell
R1-167309 Semi-persistent scheduling for 5G New Radio URLLC Nokia, Alcatel-Lucent Shanghai Bell
R1-167341 In-band full duplexing in NR HTC Corporation
R1-167388 TRP placement for the indoor scenario NTT DOCOMO, INC.
R1-167389 Draft CR on ZoD offset for UMa NLOS in TR 38.900 NTT DOCOMO, INC.
R1-167390 Use case and operational aspects for eV2X NTT DOCOMO, INC.
R1-167391 On co-existence of eMBB and URLLC NTT DOCOMO, INC.
R1-167396 Views on NR dynamic TDD NTT DOCOMO, INC.
R1-167545 mm wave RFFE technology for NR Skyworks Solutions Inc.
R1-167546 mm wave power amplifier AM/AM and AM/PM measurements Skyworks Solutions Inc.
R1-167708 Discussion on multiplexing of eMBB and URLLC Intel Corporation
R1-167771 Discussion on Beam-forming Support in NR Multicast National Taiwan University
R1-167799 Discussion on wireless relay backhauling in HF-NR National Taiwan University

8.2 Other

Including channel model for frequency spectrum above 6 GHz

R1-168420 Chairman's notes of AI 8.2 Ad-Hoc chair (Nokia)

Channel model TR38.900

Section 3
R1-167927 Definitions, symbols and abbreviations in Section 3 of TR38.900 Huawei, HiSilicon
Revision of R1-167228
Revised in R1-168001 with only the changes for sections 3.2 and 3.3 (CR0002r1)

Section 4
R1-168000 Applicability of TR38.900 Huawei, HiSilicon
Revision of R1-167860
1st bullet: Add "For system level simulations"
4th bullet: Add "For the stochastic model"
Remove the changes-on-changes
Revised in R1-168002 with the above changes.

Section 6
R1-167806 TR38.900_CR_Section_6 Fraunhofer HHI
Agreed in R1-168003 as Cat-F.

Section 7.1
R1-167809 TR38.900_CR_Section_7.1 Fraunhofer HHI
Agreed in R1-168004 as Cat-F, with comment removed.

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Section 7.2
R1-167811 TR38.900_CR_Section_7.2 Fraunhofer HHI

Section 7.3
R1-167812 TR38.900_CR_Section_7.3 Fraunhofer HHI
Agreed in R1-168005 as Cat-F with correct change-tracking in the table.

Section 7.4
R1-167818 TR38.900_CR_Section_7.4 Fraunhofer HHI
R1-167229 Editorial correction to path loss equations in Section 7.4 of TR38.900 Huawei, HiSilicon
Covered by R1-167818

Section 7.5
R1-168109 TR38.900_CR_Section_7.5 Fraunhofer HHI
Revision of R1-167819
Merged into in R1-168023.

R1-167223 CR for cluster DS of indoor office in TR 38.900 Huawei, HiSilicon
Discuss offline what should be the right values - revision in R1-168007.
Revisit at RAN1#86bis.

R1-167230 Clarifications and corrections to fast fading model in Section 7.5 of TR38.900 Huawei, HiSilicon
Double-check offline the numbers below Table 7.5-7.
Remove unspecified scenarios from step 1.
Check offline with Samsung regarding the other changes to steps 1-5 and other comments.
Revision in R1-168008
Agreed in principle. Add section 7.6 on the cover sheet. Consider whether any merging with other CRs is needed. Revised version -> R1-168023.

R1-167476 Correction for mean ZOA Ericsson
R1-167232 Correction on average ZOA for indoor UTs in TR 38.900 Huawei, HiSilicon
Covered by R1-167476.

R1-167478 Correction for RMa shadow fading Ericsson
Revised in R1-168021.

R1-167481 Correction to UMi O2I delay spread Ericsson
R1-167482 Correction for ZOA scaling factor Ericsson
To be taken into account in revision of R1-167819.

R1-167234 Correction on the phase difference between antenna panels without calibration Huawei, HiSilicon
May discuss separately in NR evaluation assumptions.

Section 7.6.1
R1-166486 Draft CR on oxygen absorption CATT
Agreed in R1-168009 CRxxxx, with addition of apostrophe in “clusters” below table 7.6.1-1.

Section 7.6.2.1
R1-167824 TR38.900_CR_Section_7.6.2.1 Fraunhofer HHI, Huawei, HiSilicon
R1-166809 Correction on large antenna array support in TR38.900 Samsung
Discuss offline how to merge R1-167824 and R1-166809. Prepare revision in R1-168010.

Section 7.6.2.2
R1-167920 TR38.900_CR_Section_7.6.2.2 Fraunhofer HHI, Huawei, HiSilicon
Revision of R1-167825
R1-166640 Draft CR on reference table to correlation distance for large bandwidth/antenna array NEC
Covered by R1-167920.

Section 7.6.3
R1-168110 TR38.900_CR_Section_7.6.3 Fraunhofer HHI
Agreed in principle, but to be revisited after merging any other changes from revision of R1-167236 -> R1-168012.
Revision of R1-167826

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Section 7.6.3.1
R1-166808 Draft CR on spatially consistent random variable clarification in TR38.900 Samsung
Move to an earlier section of the TR - prepare a revision offline - R1-168011.
Agreed in R1-168478.

R1-167236 Correction to the spatial consistency Section 7.6.3 of TR38.900 Huawei, HiSilicon
Discuss offline with Samsung which changes are agreeable.
Note typos in "maybe 2D processes with Uniformely distributed (delays and angles) or Normaly"
Put references in correct section.
Merge any agreeable changes into R1-168012.

Section 7.6.3.3
R1-167472 Clarification and correction of the soft LOS state model in TR 38.900 Ericsson
R1-167479 Correction to soft LOS state Ericsson, Intel
Already included in R1-168010.

R1-167480 Correction for spatial consistency of indoor distance Ericsson
R1-167623 Corrections on spatial consistency across floors in TR 38.900 ZTE Corporation, ZTE Microelectronics
Agreed in R1-168013 CRxxxx.

Section 7.6.4
R1-168151 Correction of blockage modeling Intel Corporation, Nokia, Alcatel-Lucent Shanghai Bell, Huawei, HiSilicon, InterDigital, Qualcomm, Samsung
Revision of R1-166572
R1-167918 TR38.900_CR_Section_7.6.4 Fraunhofer HHI
Revision of R1-167829
Includes R1-168151. Discuss offline.
Revised in R1-168329.

Section 7.6.6
R1-166571 Correction of time varying Doppler definition Intel Corporation, Samsung, InterDigital
R1-168113 TR38.900_CR_Section_7.6.6 Fraunhofer HHI
Revision of R1-167836
Discuss offline - revisit on Friday.
Revised in R1-168330.

Section 7.7.1, 7.7.2
R1-167237 Correction to the TDL-E and CDL-E Huawei, HiSilicon

Section 7.7.2
R1-167474 Correction for Doppler spectrum of TDLs Ericsson
Revise in R1-168014 with definition of fD and changing "frequency" to "shift".

R1-167477 Correction to MIMO extension of TDLs Ericsson

Section 7.7.3
R1-166810 Draft CR on delay scaling parameters in LLS channel model in TR38.900 Samsung
Discuss offline which values to use, and show the deleted table -> R1-168015.
Agreed in R1-168479.

R1-167830 TR38.900_CR_Section_7.7.3 Fraunhofer HHI

Section 7.7.4
R1-168111 TR38.900_CR_Section_7.7.4 Fraunhofer HHI
Revision of R1-167831
Agreed in R1-168016 with correct figure number references and delete the problem description text.

R1-167238 Correction of angular scaling parameters of CDL models in TR38.900 Huawei, HiSilicon
Superseded by R1-168016.

Section 7.7.5
R1-166811 Draft CR on CDL channel models in TR38.900 Samsung
Covered by R1-167919.
R1-167919 TR38.900_CR_Section_7.7.5 Fraunhofer HHI

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Revision of R1-167832

Section 7.7.6
R1-167473 Identified errors in K-factor scaling for TDL-D/E in TR 38.900 Ericsson
R1-167475 Correction for K-factor scaling of TDL models Ericsson
Agreed in principle; discuss offline the correct terminology for K_{1sttap} -> R1-168017.
Note that a further modification may be considered at RAN1#86bis to show how the formulae in the last table depend on the figures in the previous table.

R1-167242 Correction to K factor scaling in Table 7.7.6-2 Huawei, HiSilicon
Covered by R1-167475.

Section 7.7.5.1
R1-167233 Correction on the translation equation for scaling of angles in TR 38.900 Huawei, HiSilicon
Covered by R1-167919.

Section 7.8
R1-168138 Correction on Calibration Simulation Assumption in TR38.900 Samsung, Intel
Agreed in R1-168480.

Section 7.8.1 & 7.8.2
R1-167579 CR for TR38.900 to capture large and full scale calibration Samsung

Section 7.6.2.1, 7.8.2, 7.8.3
R1-167580 Draft CR for TR38.900 for editorials and minor corrections Samsung
Changes in only sections 7.8.2 and 7.8.3 are agreed in R1-168018. Other changes are already covered elsewhere.
Agreed in R1-168477.

Section 8.4
R1-168112 TR38.900_CR_Section_8.4 Fraunhofer HHI
Revision of R1-167833
Discuss offline how to handle the dependencies with section 7.5 -> R1-168019 **-> R1-168022** - revisit on Friday.

Miscellaneous
R1-167227 General discussion on the TR38.900 Huawei, HiSilicon
Discuss offline any remaining issues and prepare CRs for any remaining corrections that seem agreeable.
2 remaining issues:
1. 2D vs 3D pathloss
2. Multi-frequency simulation clarifications

Prepare a CR for consideration at RAN1#86bis.

R1-168153 TR38.900_CR_Consistent_Equation_Numbering Fraunhofer HHI, CATT, Huawei, HiSilicon, Ericsson

R1-167117 Full calibration for channel model above 6GHz CMCC
R1-168020 E-mail discussion summary on additional feature calibrations Samsung
Revision of R1-167581
Email discussion until 30th September to collect calibration data for additional features.

Other
R1-167310 Sidelink design for NR Qualcomm Incorporated

9 Closing of the meeting

Mr Chair thanked all for really appreciated hard work during the week. Special thanks to V2V team who closed Thursday session very late (23:55).
V2V rapporteur (LGE) asked for taking the floor and thanked Shailesh Patil (Qualcomm) for his work – the best to Shailesh in his future position out of RAN1.
Thanks also to the European Friends of 3GPP for hosting and organizing meeting room facilities for such big meeting.
Mr Chair thanked Vice chairs and all the chair persons who help managing the number of parallel sessions during the course of the week.
Question was raised clarifying the NR scheduling for upcoming meetings

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Mr Chair confirmed that Way Forward (especially on multiple access schemes) are welcome to next meeting. Any contribution submission is welcome but RAN1 chair warned the group that RAN1 had only 3 meetings left before the completion of the NR SI, including January ad-hoc additional meeting. Agenda to next upcoming meetings shall take into account this constraint.
ZTE commented that online discussions do not preclude offline/email discussions to progress further
Ericsson still believe that RAN1 should strive reaching progress online
Meeting was closed at 17:00.
See you all in Lisbon.

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Annex A: List of Tdocs at RAN1 #86

Please see excel file attached to this report

Petitioners' Exhibit 1007, p. 1753
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Annex B: List of CRs agreed at RAN1 #86

TDoc #	Title	Source	Release	Spec #	Version	Related WIs	CR #	CR revision #	CR category

Petitioners' Exhibit 1007, p. 1754
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Annex C-1: List of Outgoing LSs from RAN1 #86

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in

Petitioners' Exhibit 1007, p. 1755
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3GPP TSG RAN WG1 Meeting #86bis R1-16xxxx
Lisbon, Portugal, 10th – 14th October 2016

Annex C-2: List of Incoming LSs from RAN1 #86

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in

Petitioners' Exhibit 1007, p. 1756
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Annex D: List of Approved updated WIDs

None

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Annex E: List of draft TSs/TRs agreed at RAN1 #86

Tdoc Number	Title	Source	Conclusion/Decision
R1-168526	TR 38.802 V0.1.0 Study on New Radio (NR) Access Technology - Physical Layer Aspects	NTT DOCOMO, INC.	Endorsed

Petitioners' Exhibit 1007, p. 1758
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Annex F: List of actions

- **Outgoing LS.**

[86-21] Asbjorn (Ericsson)
LS to RAN2 about NE initial access and mobility
Email approval until 1st September to tell the current RAN1 agreements and WA to RAN2
Done: Final LS is agreed in R1-168214 as per Mr Chair's decision posted on Sept 2nd.

- **CR approval**

[86-01] Bob (Motorola Mobility)
R1-167507 Addition of LTE_LATRED_L2-Core Ericsson LM
CR0709 of 36.213 is for email approval until Sept 12th.

[86-02] Suzuki (Panasonic)
R1-167434 Clarification of valid subframe in eMTC Panasonic Corporation
Email discussion/approval until Sep. 1st
Done: CR0725r1 to 36.213 is agreed in R1-168213 as per Mr Chair's decision posted on Sept 2nd.

[86-03] Johan (Ericsson)
CR for PUCCH retuning for BL/CE UE
Email approval until 2nd Sep.

[86-04] Editors
eLAA CRs
Editors will provide updated draft CRs including the agreements and WA until 6th Sep., and email approval until 12th Sep.
Rapporteur will provide agreement lists until 29th August.

[86-05] Editors
V2V CRs
Editors will provide updated draft CRs including the agreements and WA until 6th Sep., and email approval until 12th Sep.
Rapporteur will provide agreement lists until 29th August.

[86-40] Harish (Qualcomm)
HS-SCCH DRX feature
R1-167814 Introduction of HS-SCCH Order for HS-SCCH DRx feature in enhanced Cell Fach Qualcomm Europe Inc.(France)
R1-167815 UE Procedures for HS-SCCH DRx feature in enhanced Cell Fach Qualcomm Europe Inc.(France)

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Email discussion until Sept 9th. on Qualcomm CRs.

- **Text proposal for TS and TR**

None

- **Miscellaneous**

[86-06] Philippe (Huawei)
Threshold values for V2V
Email discussion until 2nd Sept. on the numbers in the brackets

[86-07] Hanbyul (LGE)
Energy measurement in each sub-channel for V2V
Email discussion until 2nd September

[86-08] Stefano (Ericsson)
R1-168348 WF on CBR measurement – Ericsson
Email discussion until 2nd September

[86-09] Stefano (Ericsson)
R1-168080 WF on V2V congestion control - Ericsson
Email discussion until 2nd September

[86-10] Hanbyul (LGE)
Candidate size for V2V
Email discussion until 2nd September

[86-11] Shailesh (Qualcomm)
DCI for V2V
Email discussion to finalize the square-bracketed figure and FFS until 2nd September

[86-12] Philippe (Huawei)
SCI contents for V2V
Email discussion until 2nd September to confirm the working assumption and square-bracketed figures, and the details of joint encoding of frequency location of the other transmission and number of subchannels

[86-13] Hanbyul (LGE)

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PSD offset for V2V for email approval until September 1st
Done: According to Mr Chair's email dated on Sept 2nd, the PSD offset is fixed to [3] dB in specifications.
Note that exact fixed value can be discussed in the next meeting by seeing more evaluation results and analysis.

[86-14] Mark (Ericsson)
Antenna Port Layouts for FD-MIMO
Email discussion until the next meeting

[86-15] Yi (Huawei)
SLS baseline for NR MA
Email discussion on any other potential parameters until 2nd Sep.

[86-16] Yi (Huawei)
Templates for NR MA
Huawei will provide the initial version of template for preliminary simulation results summary by 9th Sept, and email discussion about this template by 16th Sep

[86-17] Yi (Huawei)
SLS calibration for NR MA
Email discussion until 16th Sep.

[86-18] Yifei (ZTE)
Categorization for NR MA schemes
Email discussion until the next meeting

[86-19] Joseph (Qualcomm)
Use cases discussion for time domain structure for NR
Email discussion where proponents provide further input on use cases with completion by 15th Sep.

[86-20] Ruyue (ZTE)
MIMO calibration for NR
Email discussion until 8th Sep.

[86-22] Kazuaki (NTT DOCOMO)
Target packet drop rate for NR
Email discussion on the two options of the packet size and clarification on Target packet drop rate
as listed in R1-168510 until 1st Sep.

[86-23] Martin (Sony)

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Battery lifetime model for NR
Email discussion on battery lifetime model in R1-168485 until the next meeting

[86-24] Wu Yong (Huawei)
Traffic model for NR
Email discussion on traffic model for urban coverage for massive connection (UL) (until 15th Sep)

[86-25] Haitong (Qualcomm)
Path loss calibration for NR
Email discussion for path loss calibration for 3D UMa at carrier frequency of 700 MHz until 9th Sep.

[86-26] Young-Han (Samsung)
R1-168537 WF on Dense Urban Scenarios
Email approval until 8th September

[86-27] Na (NTT DOCOMO)
R1-168421 WF on Indoor TRP Configuration
Email discussion until 2nd Sep.

[86-28] Young-Han (Samsung)
Additional feature calibration for channel model
Email discussion until 30th September to collect calibration data for additional features

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Annex G: List of participants at RAN1 #86

Please see excel file attached to this report

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Annex H: **TSG RAN WG1 meetings in 2016 – 2017**

TITLE	TYPE	DATES	LOCATION	CTRY
3GPPRAN1#86bis	WG	10 – 14 Oct 2016	Lisbon	Portugal
3GPPRAN1#87	WG	14 – 18 Nov 2016	Reno	US
3GPPRAN1-NR	AH	16 – 20 Jan 2017	TBD	TBD
3GPPRAN1#88	WG	13 – 17 Feb 2017	Athens	Greece
3GPPRAN1#88bis	WG	03 – 07 Apr 2017	TBD	US
3GPPRAN1#89	WG	15 – 19 May 2017	TBD	China
3GPPRAN1-NR	AH	27 – 30 Jun 2017	TBD	TBD
3GPPRAN1#90	WG	21 – 25 Aug 2017	Prague (TBC)	Rep Czech
3GPPRAN1#90bis	WG	09 – 13 Oct 2017	Prague (TBC)	Rep Czech
3GPPRAN1#91	WG	27 Nov – 01 Dec 2017	TBD	US

MEETING TYPES	
AH = Ad Hoc	CM = Chairmen's meeting
JM = Joint	OR = Ordinary
PM = Preparatory Meeting	RG = Rapporteurs Group
RM = Resolution Meeting	SG = Steering Group
ST = Startup Meeting	TG = Task Group
WG = Working Group	XO = Extraordinary

End of document

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APPENDIX 33

www.3gpp.org / ftp / tsg_ran / WG1_RL1 / TSGR1_85 / Docs

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R1-164063.zip	2016/05/14 2:17	181,2 KB
R1-164064.zip	2016/05/14 2:17	157,6 KB
R1-164065.zip	2016/05/14 2:17	43,5 KB
R1-164066.zip	2016/05/14 2:17	104,9 KB
R1-164067.zip	2016/05/14 2:17	99,7 KB
R1-164068.zip	2016/05/14 2:17	106,8 KB
R1-164069.zip	2016/05/14 2:17	192,5 KB
R1-164070.zip	2016/05/14 2:17	186,6 KB
R1-164071.zip	2016/05/14 2:08	60,1 KB
R1-164072.zip	2016/05/14 2:08	56,6 KB
R1-164073.zip	2016/05/14 2:08	137,9 KB
R1-164074.zip	2016/05/14 2:08	85,5 KB
R1-164075.zip	2016/05/14 2:08	176,9 KB
R1-164076.zip	2016/05/14 2:08	137,2 KB
R1-164077.zip	2016/05/14 2:08	269 KB
R1-164078.zip	2016/05/14 2:08	124,3 KB
R1-164079.zip	2016/05/14 2:08	49,1 KB
R1-164080.zip	2016/05/14 2:08	39,9 KB
R1-164081.zip	2016/05/14 2:17	22,2 KB
R1-164082.zip	2016/05/14 2:08	123,2 KB
R1-164083.zip	2016/05/14 2:08	29,9 KB
R1-164084.zip	2016/05/14 2:08	29,3 KB
R1-164085.zip	2016/05/14 2:08	72,1 KB
R1-164086.zip	2016/05/14 2:09	519,5 KB
R1-164087.zip	2016/05/14 2:09	33,6 KB
R1-164088.zip	2016/05/14 2:09	263,3 KB
R1-164089.zip	2016/05/14 2:09	129,9 KB
R1-164090.zip	2016/05/14 2:09	588,1 KB
R1-164091.zip	2016/05/14 2:09	43,7 KB
R1-164092.zip	2016/05/14 2:09	37,9 KB

Petitioners' Exhibit 1007, p. 1769
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-164093.zip	2016/05/14 2:09	29,6 KB
R1-164094.zip	2016/05/14 2:09	189,8 KB
R1-164095.zip	2016/05/14 2:09	215,4 KB
R1-164096.zip	2016/05/14 2:09	57,2 KB
R1-164097.zip	2016/05/14 2:09	242,2 KB
R1-164098.zip	2016/05/14 2:09	166,3 KB
R1-164099.zip	2016/05/14 2:09	84,3 KB
R1-164100.zip	2016/05/14 2:09	1341,3 KB
R1-164101.zip	2016/05/14 2:09	354,1 KB
R1-164102.zip	2016/05/14 2:09	108,3 KB
R1-164103.zip	2016/05/14 2:17	96,5 KB
R1-164104.zip	2016/05/14 2:09	105,7 KB
R1-164105.zip	2016/05/14 2:09	100,8 KB
R1-164106.zip	2016/05/14 2:09	240,2 KB
R1-164107.zip	2016/05/14 2:17	67 KB
R1-164108.zip	2016/05/14 2:17	62,2 KB
R1-164109.zip	2016/05/14 2:17	59,3 KB
R1-164110.zip	2016/05/14 2:17	57,1 KB
R1-164111.zip	2016/05/14 2:17	74,2 KB
R1-164112.zip	2016/05/14 2:09	710 KB
R1-164113.zip	2016/05/14 2:09	197,4 KB
R1-164114.zip	2016/05/06 7:38	101,4 KB
R1-164115.zip	2016/05/13 22:50	453,2 KB
R1-164116.zip	2016/05/13 15:28	805,4 KB
R1-164117.zip	2016/05/13 14:10	203,6 KB
R1-164119.zip	2016/05/06 7:38	13,2 KB
R1-164120.zip	2016/05/06 7:38	15,8 KB
R1-164121.zip	2016/05/14 6:41	140,2 KB
R1-164122.zip	2016/05/14 6:41	20,9 KB
R1-164123.zip	2016/05/14 6:41	106,8 KB
R1-164124.zip	2016/05/14 6:41	28 KB
R1-164125.zip	2016/05/14 6:41	62,7 KB
R1-164126.zip	2016/05/14 6:42	50,8 KB
R1-164127.zip	2016/05/14 6:42	261,2 KB

Petitioners' Exhibit 1007, p. 1770
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-164128.zip	2016/05/14 6:42	58 KB
R1-164129.zip	2016/05/14 6:42	94,9 KB
R1-164130.zip	2016/05/14 6:42	117,2 KB
R1-164131.zip	2016/05/14 6:42	108,6 KB
R1-164132.zip	2016/05/14 6:42	495,4 KB
R1-164133.zip	2016/05/14 6:42	56,8 KB
R1-164134.zip	2016/05/14 6:42	359,6 KB
R1-164135.zip	2016/05/14 6:42	514,3 KB
R1-164136.zip	2016/05/14 6:43	74,4 KB
R1-164137.zip	2016/05/14 6:43	304,3 KB
R1-164138.zip	2016/05/14 6:43	98,8 KB
R1-164139.zip	2016/05/14 6:43	339,1 KB
R1-164140.zip	2016/05/14 6:43	846,1 KB
R1-164141.zip	2016/05/14 6:43	782,9 KB
R1-164142.zip	2016/05/14 6:43	240,1 KB
R1-164143.zip	2016/05/14 6:43	114,7 KB
R1-164144.zip	2016/05/14 6:43	85,7 KB
R1-164145.zip	2016/05/14 6:43	140 KB
R1-164146.zip	2016/05/14 6:44	118,7 KB
R1-164147.zip	2016/05/14 6:44	95,5 KB
R1-164148.zip	2016/05/14 6:44	208,3 KB
R1-164149.zip	2016/05/14 6:44	191,6 KB
R1-164150.zip	2016/05/14 6:44	416,1 KB
R1-164151.zip	2016/05/14 6:44	103,6 KB
R1-164152.zip	2016/05/14 6:44	160,3 KB
R1-164153.zip	2016/05/14 6:44	165 KB
R1-164154.zip	2016/05/14 6:44	55,8 KB
R1-164155.zip	2016/05/14 6:44	52,9 KB
R1-164156.zip	2016/05/14 6:45	53 KB
R1-164157.zip	2016/05/14 6:45	110,8 KB
R1-164158.zip	2016/05/14 6:45	657,9 KB
R1-164159.zip	2016/05/14 6:45	528 KB
R1-164160.zip	2016/05/14 6:45	251,8 KB
R1-164161.zip	2016/05/14 6:45	407,3 KB

Petitioners' Exhibit 1007, p. 1771
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-164162.zip	2016/05/14 6:45	125,2 KB
R1-164163.zip	2016/05/14 6:45	63,9 KB
R1-164164.zip	2016/05/14 6:45	391,1 KB
R1-164165.zip	2016/05/14 6:45	45,1 KB
R1-164166.zip	2016/05/14 6:45	339 KB
R1-164167.zip	2016/05/14 6:46	41,7 KB
R1-164168.zip	2016/05/14 6:46	68,6 KB
R1-164169.zip	2016/05/14 6:45	39,6 KB
R1-164170.zip	2016/05/14 6:45	301,5 KB
R1-164171.zip	2016/05/14 6:46	432,6 KB
R1-164172.zip	2016/05/14 6:46	92,5 KB
R1-164173.zip	2016/05/14 6:46	61,8 KB
R1-164174.zip	2016/05/14 6:46	414,4 KB
R1-164175.zip	2016/05/14 6:46	192,8 KB
R1-164176.zip	2016/05/14 6:46	406 KB
R1-164177.zip	2016/05/14 6:46	697,2 KB
R1-164178.zip	2016/05/14 6:46	77,9 KB
R1-164179.zip	2016/05/14 7:23	58,8 KB
R1-164180.zip	2016/05/14 6:46	129,6 KB
R1-164181.zip	2016/05/14 6:46	73,9 KB
R1-164182.zip	2016/05/14 6:46	79,5 KB
R1-164183.zip	2016/05/14 6:47	33,8 KB
R1-164184.zip	2016/05/14 6:47	102,8 KB
R1-164185.zip	2016/05/14 6:47	84,4 KB
R1-164186.zip	2016/05/14 6:46	165,9 KB
R1-164187.zip	2016/05/14 6:47	58,5 KB
R1-164188.zip	2016/05/14 6:47	314,4 KB
R1-164189.zip	2016/05/14 6:47	93,7 KB
R1-164190.zip	2016/05/14 6:47	52,6 KB
R1-164191.zip	2016/05/14 6:47	594,1 KB
R1-164192.zip	2016/05/14 6:47	219,5 KB
R1-164193.zip	2016/05/14 6:47	196 KB
R1-164194.zip	2016/05/14 6:47	746,7 KB
R1-164195.zip	2016/05/14 6:48	1445,5 KB

Petitioners' Exhibit 1007, p. 1772
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sort by name/desc	sort by date/desc	sort by size/desc
R1-164196.zip	2016/05/14 1:10	166,8 KB
R1-164197.zip	2016/05/14 1:10	1158,8 KB
R1-164198.zip	2016/05/14 1:10	17,9 KB
R1-164199.zip	2016/05/14 1:10	254,5 KB
R1-164200.zip	2016/05/14 1:10	52,3 KB
R1-164201.zip	2016/05/14 1:10	90,5 KB
R1-164203.zip	2016/05/14 1:10	86,5 KB
R1-164204.zip	2016/05/14 1:10	134 KB
R1-164205.zip	2016/05/14 1:10	57,6 KB
R1-164206.zip	2016/05/14 1:10	159,7 KB
R1-164207.zip	2016/05/14 1:10	81,4 KB
R1-164208.zip	2016/05/14 1:10	131,9 KB
R1-164209.zip	2016/05/14 1:10	69 KB
R1-164210.zip	2016/05/14 1:10	1014,3 KB
R1-164211.zip	2016/05/14 1:10	387,7 KB
R1-164212.zip	2016/05/14 1:10	73,5 KB
R1-164213.zip	2016/05/14 1:10	61,6 KB
R1-164214.zip	2016/05/14 1:10	86,9 KB
R1-164215.zip	2016/05/14 1:10	130,3 KB
R1-164216.zip	2016/05/14 1:10	42 KB
R1-164217.zip	2016/05/14 1:10	31 KB
R1-164218.zip	2016/05/14 1:10	50,3 KB
R1-164219.zip	2016/05/14 1:10	49,5 KB
R1-164220.zip	2016/05/14 1:10	36,3 KB
R1-164221.zip	2016/05/14 1:10	61,4 KB
R1-164222.zip	2016/05/14 1:10	329,1 KB
R1-164223.zip	2016/05/14 1:10	76,3 KB
R1-164224.zip	2016/05/14 1:10	111,7 KB
R1-164225.zip	2016/05/14 1:10	211,5 KB
R1-164226.zip	2016/05/14 1:10	29,4 KB
R1-164227.zip	2016/05/14 1:10	51,6 KB
R1-164228.zip	2016/05/14 1:10	109,1 KB
R1-164229.zip	2016/05/14 1:10	45 KB
R1-164230.zip	2016/05/14 1:10	68,5 KB

Petitioners' Exhibit 1007, p. 1773
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sort by name/desc	sort by date/desc	sort by size/desc
R1-164231.zip	2016/05/14 1:10	265,5 KB
R1-164232.zip	2016/05/14 1:10	49,8 KB
R1-164233.zip	2016/05/14 1:10	45,4 KB
R1-164234.zip	2016/05/14 1:10	454,2 KB
R1-164235.zip	2016/05/14 1:10	278,1 KB
R1-164236.zip	2016/05/14 1:10	398,6 KB
R1-164237.zip	2016/05/14 1:10	255,5 KB
R1-164238.zip	2016/05/14 1:10	23,5 KB
R1-164239.zip	2016/05/14 1:10	825,8 KB
R1-164240.zip	2016/05/14 1:10	76,9 KB
R1-164241.zip	2016/05/14 1:10	28,1 KB
R1-164242.zip	2016/05/14 1:10	54,8 KB
R1-164243.zip	2016/05/14 1:10	397,8 KB
R1-164244.zip	2016/05/14 1:10	83,1 KB
R1-164245.zip	2016/05/14 1:10	87,9 KB
R1-164246.zip	2016/05/14 1:10	716,5 KB
R1-164247.zip	2016/05/14 1:09	184,6 KB
R1-164248.zip	2016/05/14 1:09	70,4 KB
R1-164249.zip	2016/05/14 1:09	78,4 KB
R1-164250.zip	2016/05/14 1:09	110,2 KB
R1-164251.zip	2016/05/14 1:09	391,4 KB
R1-164252.zip	2016/05/14 1:10	300 KB
R1-164253.zip	2016/05/14 1:10	387,4 KB
R1-164254.zip	2016/05/14 1:10	35,2 KB
R1-164255.zip	2016/05/14 1:10	48,5 KB
R1-164256.zip	2016/05/14 1:10	93 KB
R1-164257.zip	2016/05/14 1:37	60,4 KB
R1-164258.zip	2016/05/14 1:10	257,5 KB
R1-164259.zip	2016/05/14 1:10	1038,6 KB
R1-164260.zip	2016/05/09 8:46	22,5 KB
R1-164261.zip	2016/05/14 5:59	261 KB
R1-164262.zip	2016/05/14 5:59	60,2 KB
R1-164263.zip	2016/05/14 5:59	56,9 KB
R1-164264.zip	2016/05/14 5:59	42,3 KB

Petitioners' Exhibit 1007, p. 1774
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sort by name/desc	sort by date/desc	sort by size/desc
R1-164265.zip	2016/05/14 6:00	124,5 KB
R1-164266.zip	2016/05/14 6:00	195 KB
R1-164267.zip	2016/05/14 6:01	114,8 KB
R1-164268.zip	2016/05/14 6:01	124,7 KB
R1-164269.zip	2016/05/14 6:22	205,1 KB
R1-164270.zip	2016/05/14 6:24	119,4 KB
R1-164271.zip	2016/05/14 6:24	251,1 KB
R1-164272.zip	2016/05/14 6:24	203,9 KB
R1-164273.zip	2016/05/14 6:25	85,2 KB
R1-164274.zip	2016/05/14 6:25	155,9 KB
R1-164275.zip	2016/05/14 6:25	119 KB
R1-164276.zip	2016/05/14 6:26	193,5 KB
R1-164277.zip	2016/05/14 6:26	145,1 KB
R1-164278.zip	2016/05/14 6:27	678,8 KB
R1-164279.zip	2016/05/14 6:28	279,2 KB
R1-164280.zip	2016/05/14 6:28	124,8 KB
R1-164281.zip	2016/05/14 6:15	66,3 KB
R1-164282.zip	2016/05/14 6:15	85,2 KB
R1-164283.zip	2016/05/14 6:16	45,9 KB
R1-164284.zip	2016/05/14 6:17	66,7 KB
R1-164285.zip	2016/05/14 6:17	411 KB
R1-164286.zip	2016/05/09 16:09	2637,5 KB
R1-164287.zip	2016/05/13 17:48	174,2 KB
R1-164288.zip	2016/05/13 17:48	13,1 KB
R1-164289.zip	2016/05/13 17:48	16,8 KB
R1-164290.zip	2016/05/13 17:48	258 KB
R1-164291.zip	2016/05/13 17:48	36,9 KB
R1-164292.zip	2016/05/14 11:55	346,2 KB
R1-164293.zip	2016/05/14 8:32	169,2 KB
R1-164294.zip	2016/05/14 8:32	248,2 KB
R1-164295.zip	2016/05/14 8:32	105,8 KB
R1-164296.zip	2016/05/14 8:32	395,7 KB
R1-164297.zip	2016/05/14 8:32	148,7 KB
R1-164298.zip	2016/05/14 8:32	35,2 KB

Petitioners' Exhibit 1007, p. 1775
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sort by name/desc	sort by date/desc	sort by size/desc
R1-164299.zip	2016/05/14 8:32	31,2 KB
R1-164300.zip	2016/05/14 8:32	107,6 KB
R1-164301.zip	2016/05/14 8:32	284,8 KB
R1-164302.zip	2016/05/14 8:32	128,5 KB
R1-164303.zip	2016/05/14 8:32	271,8 KB
R1-164304.zip	2016/05/14 8:32	164,7 KB
R1-164305.zip	2016/05/16 20:23	141 KB
R1-164306.zip	2016/05/11 5:34	52,8 KB
R1-164307.zip	2016/05/11 5:34	53,1 KB
R1-164308.zip	2016/05/14 9:07	394 KB
R1-164309.zip	2016/05/14 9:07	28,5 KB
R1-164310.zip	2016/05/14 9:07	160,4 KB
R1-164311.zip	2016/05/14 9:07	125,3 KB
R1-164312.zip	2016/05/14 9:07	166,8 KB
R1-164313.zip	2016/05/14 9:07	129,8 KB
R1-164314.zip	2016/05/14 9:07	174,6 KB
R1-164315.zip	2016/05/14 9:07	92,2 KB
R1-164316.zip	2016/05/14 9:07	47,3 KB
R1-164317.zip	2016/05/14 9:07	19,8 KB
R1-164318.zip	2016/05/13 15:27	67,9 KB
R1-164319.zip	2016/05/13 21:13	119,2 KB
R1-164320.zip	2016/05/13 21:13	46,9 KB
R1-164321.zip	2016/05/13 21:13	33,3 KB
R1-164322.zip	2016/05/13 21:13	32,7 KB
R1-164323.zip	2016/05/13 21:13	55 KB
R1-164324.zip	2016/05/13 21:14	136,6 KB
R1-164325.zip	2016/05/13 21:14	31,7 KB
R1-164326.zip	2016/05/13 21:14	33,7 KB
R1-164327.zip	2016/05/13 21:14	385 KB
R1-164329.zip	2016/05/13 21:14	551,2 KB
R1-164330.zip	2016/05/13 21:14	62 KB
R1-164331.zip	2016/05/13 21:14	139,9 KB
R1-164332.zip	2016/05/13 21:14	83,1 KB
R1-164333.zip	2016/05/13 21:14	343,5 KB

Petitioners' Exhibit 1007, p. 1776
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sort by name/desc	sort by date/desc	sort by size/desc
R1-164334.zip	2016/05/13 21:14	141 KB
R1-164335.zip	2016/05/13 19:20	598,1 KB
R1-164336.zip	2016/05/13 19:20	42,8 KB
R1-164337.zip	2016/05/13 19:20	86,2 KB
R1-164338.zip	2016/05/13 19:20	150,3 KB
R1-164339.zip	2016/05/13 19:20	42,5 KB
R1-164341.zip	2016/05/13 19:19	92,3 KB
R1-164342.zip	2016/05/13 19:19	31,9 KB
R1-164343.zip	2016/05/13 19:20	281,4 KB
R1-164344.zip	2016/05/13 19:20	38,3 KB
R1-164345.zip	2016/05/12 1:36	34,8 KB
R1-164346.zip	2016/05/10 12:31	13,4 KB
R1-164347.zip	2016/05/10 12:31	32,9 KB
R1-164348.zip	2016/05/10 12:31	46,6 KB
R1-164349.zip	2016/05/12 13:13	42,2 KB
R1-164351.zip	2016/05/14 4:33	962,3 KB
R1-164352.zip	2016/05/14 4:33	261,9 KB
R1-164353.zip	2016/05/14 4:33	59,8 KB
R1-164354.zip	2016/05/13 21:25	36,5 KB
R1-164355.zip	2016/05/13 21:26	3188,1 KB
R1-164356.zip	2016/05/14 5:47	169,3 KB
R1-164357.zip	2016/05/14 5:47	42,5 KB
R1-164358.zip	2016/05/14 5:47	305,5 KB
R1-164359.zip	2016/05/14 5:47	273,3 KB
R1-164360.zip	2016/05/14 5:47	47,1 KB
R1-164361.zip	2016/05/14 5:47	106 KB
R1-164362.zip	2016/05/14 6:58	175,5 KB
R1-164363.zip	2016/05/14 6:58	30,6 KB
R1-164364.zip	2016/05/14 6:57	114,6 KB
R1-164365.zip	2016/05/14 6:57	32,1 KB
R1-164366.zip	2016/05/14 6:57	32,1 KB
R1-164367.zip	2016/05/14 6:57	15,1 KB
R1-164368.zip	2016/05/14 6:57	15,1 KB
R1-164369.zip	2016/05/15 21:19	114,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164370.zip	2016/05/15 21:19	48 KB
R1-164371.zip	2016/05/15 21:19	101,2 KB
R1-164372.zip	2016/05/14 3:35	158 KB
R1-164373.zip	2016/05/14 3:35	29,8 KB
R1-164374.zip	2016/05/14 3:35	119,9 KB
R1-164375.zip	2016/05/14 3:35	193,7 KB
R1-164376.zip	2016/05/14 2:09	294,9 KB
R1-164377.zip	2016/05/14 3:35	183,6 KB
R1-164378.zip	2016/05/14 3:35	146,5 KB
R1-164379.zip	2016/05/15 21:22	390 KB
R1-164380.zip	2016/05/15 21:22	152,5 KB
R1-164381.zip	2016/05/15 21:22	242,7 KB
R1-164382.zip	2016/05/15 21:22	58,2 KB
R1-164383.zip	2016/05/15 21:22	69,7 KB
R1-164384.zip	2016/05/15 21:22	226,9 KB
R1-164385.zip	2016/05/15 21:22	363,1 KB
R1-164386.zip	2016/05/15 21:22	38,1 KB
R1-164387.zip	2016/05/15 21:22	29 KB
R1-164388.zip	2016/05/15 21:22	127,7 KB
R1-164389.zip	2016/05/15 21:22	150,8 KB
R1-164390.zip	2016/05/15 21:22	377,7 KB
R1-164391.zip	2016/05/15 21:22	61,5 KB
R1-164393.zip	2016/05/14 1:48	32,3 KB
R1-164394.zip	2016/05/14 1:38	27,2 KB
R1-164395.zip	2016/05/14 1:36	32,3 KB
R1-164396.zip	2016/05/14 2:13	29,8 KB
R1-164397.zip	2016/05/14 2:13	24,8 KB
R1-164398.zip	2016/05/14 2:06	190,5 KB
R1-164399.zip	2016/05/14 2:03	422,2 KB
R1-164400.zip	2016/05/14 2:03	33,7 KB
R1-164401.zip	2016/05/14 2:03	35,3 KB
R1-164402.zip	2016/05/14 2:03	105,3 KB
R1-164403.zip	2016/05/14 7:20	976,2 KB
R1-164404.zip	2016/05/14 1:27	236,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164405.zip	2016/05/14 1:48	36,4 KB
R1-164406.zip	2016/05/14 2:30	35,3 KB
R1-164407.zip	2016/05/14 2:30	30,9 KB
R1-164408.zip	2016/05/14 2:30	29,3 KB
R1-164409.zip	2016/05/14 2:30	91,3 KB
R1-164410.zip	2016/05/14 2:30	35 KB
R1-164411.zip	2016/05/14 2:30	32,2 KB
R1-164412.zip	2016/05/14 2:31	34,2 KB
R1-164413.zip	2016/05/14 2:31	142,4 KB
R1-164414.zip	2016/05/14 2:31	31,8 KB
R1-164415.zip	2016/05/14 2:31	35 KB
R1-164416.zip	2016/05/14 2:31	30,4 KB
R1-164417.zip	2016/05/14 2:43	226 KB
R1-164418.zip	2016/05/14 2:43	54,9 KB
R1-164419.zip	2016/05/14 2:42	161,2 KB
R1-164420.zip	2016/05/14 2:42	41,9 KB
R1-164421.zip	2016/05/14 2:43	43,6 KB
R1-164422.zip	2016/05/14 2:43	41,5 KB
R1-164423.zip	2016/05/14 2:43	48,6 KB
R1-164424.zip	2016/05/14 2:43	217,7 KB
R1-164425.zip	2016/05/14 2:43	49 KB
R1-164426.zip	2016/05/14 2:43	24,9 KB
R1-164427.zip	2016/05/14 2:50	162,4 KB
R1-164428.zip	2016/05/14 2:50	106,7 KB
R1-164429.zip	2016/05/14 2:50	147,5 KB
R1-164430.zip	2016/05/14 2:50	124,1 KB
R1-164431.zip	2016/05/14 2:50	98,3 KB
R1-164432.zip	2016/05/14 2:50	289,6 KB
R1-164433.zip	2016/05/14 2:50	53,1 KB
R1-164434.zip	2016/05/14 2:58	35,9 KB
R1-164435.zip	2016/05/14 2:58	162,2 KB
R1-164436.zip	2016/05/14 2:58	123,8 KB
R1-164437.zip	2016/05/14 2:58	53,9 KB
R1-164438.zip	2016/05/14 3:11	204 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164439.zip	2016/05/14 3:11	241 KB
R1-164440.zip	2016/05/14 3:11	87,5 KB
R1-164441.zip	2016/05/14 3:11	119,2 KB
R1-164442.zip	2016/05/14 3:11	116,9 KB
R1-164443.zip	2016/05/14 3:11	79,9 KB
R1-164444.zip	2016/05/14 3:29	224,7 KB
R1-164445.zip	2016/05/14 3:29	79,5 KB
R1-164446.zip	2016/05/14 3:29	176,5 KB
R1-164447.zip	2016/05/14 3:29	32,7 KB
R1-164448.zip	2016/05/14 3:29	463,8 KB
R1-164449.zip	2016/05/14 3:29	1386,2 KB
R1-164450.zip	2016/05/14 3:29	104,2 KB
R1-164451.zip	2016/05/14 3:29	38,4 KB
R1-164452.zip	2016/05/14 3:29	33,7 KB
R1-164453.zip	2016/05/14 3:29	429,2 KB
R1-164454.zip	2016/05/14 3:41	33,3 KB
R1-164455.zip	2016/05/14 3:41	45,5 KB
R1-164456.zip	2016/05/14 3:41	120,6 KB
R1-164457.zip	2016/05/14 3:41	23,4 KB
R1-164458.zip	2016/05/14 3:47	185,3 KB
R1-164459.zip	2016/05/14 3:48	450,1 KB
R1-164460.zip	2016/05/14 3:48	482,2 KB
R1-164461.zip	2016/05/14 3:48	480,9 KB
R1-164462.zip	2016/05/14 3:48	322,6 KB
R1-164464.zip	2016/05/14 3:48	852,8 KB
R1-164465.zip	2016/05/14 3:47	753,3 KB
R1-164466.zip	2016/05/13 9:21	226 KB
R1-164467.zip	2016/05/13 9:21	41,9 KB
R1-164468.zip	2016/05/13 9:21	43,5 KB
R1-164469.zip	2016/05/13 9:21	43,8 KB
R1-164470.zip	2016/05/13 9:21	75,7 KB
R1-164471.zip	2016/05/13 9:21	14 KB
R1-164472.zip	2016/05/13 9:21	57 KB
R1-164473.zip	2016/05/13 5:35	61,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164474.zip	2016/05/13 5:35	186,5 KB
R1-164475.zip	2016/05/13 5:35	38,5 KB
R1-164476.zip	2016/05/13 5:35	35,8 KB
R1-164477.zip	2016/05/13 5:35	25 KB
R1-164478.zip	2016/05/13 5:35	62,2 KB
R1-164479.zip	2016/05/13 5:34	408 KB
R1-164480.zip	2016/05/13 5:34	85,5 KB
R1-164481.zip	2016/05/13 5:34	198,1 KB
R1-164482.zip	2016/05/13 5:34	37,3 KB
R1-164483.zip	2016/05/13 5:34	100 KB
R1-164484.zip	2016/05/13 5:35	182,1 KB
R1-164485.zip	2016/05/13 5:35	39,6 KB
R1-164486.zip	2016/05/13 5:35	46,9 KB
R1-164487.zip	2016/05/13 9:24	80,5 KB
R1-164488.zip	2016/05/13 9:24	53,8 KB
R1-164489.zip	2016/05/13 5:35	289,3 KB
R1-164490.zip	2016/05/14 4:05	27 KB
R1-164491.zip	2016/05/14 4:05	31,8 KB
R1-164492.zip	2016/05/14 4:05	28,2 KB
R1-164493.zip	2016/05/14 4:05	33,5 KB
R1-164494.zip	2016/05/14 4:05	36 KB
R1-164495.zip	2016/05/14 4:05	63,9 KB
R1-164496.zip	2016/05/14 4:05	77,7 KB
R1-164497.zip	2016/05/14 4:05	50,1 KB
R1-164498.zip	2016/05/14 4:05	37,6 KB
R1-164499.zip	2016/05/14 4:05	32 KB
R1-164500.zip	2016/05/14 4:05	50,7 KB
R1-164501.zip	2016/05/14 4:05	31,7 KB
R1-164502.zip	2016/05/14 4:06	157,5 KB
R1-164503.zip	2016/05/14 4:06	86,6 KB
R1-164504.zip	2016/05/14 4:06	276,2 KB
R1-164505.zip	2016/05/14 4:06	28,5 KB
R1-164506.zip	2016/05/14 4:06	28,6 KB
R1-164507.zip	2016/05/14 5:13	234,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164508.zip	2016/05/14 5:13	107,1 KB
R1-164509.zip	2016/05/14 5:13	81,9 KB
R1-164510.zip	2016/05/14 5:13	155,7 KB
R1-164511.zip	2016/05/14 5:13	72,2 KB
R1-164512.zip	2016/05/14 5:13	60,7 KB
R1-164513.zip	2016/05/14 5:13	58,9 KB
R1-164514.zip	2016/05/14 5:13	76,5 KB
R1-164515.zip	2016/05/14 5:13	69,7 KB
R1-164516.zip	2016/05/14 5:13	111,8 KB
R1-164517.zip	2016/05/14 5:13	63,6 KB
R1-164518.zip	2016/05/14 5:13	59,5 KB
R1-164519.zip	2016/05/14 5:13	62,8 KB
R1-164520.zip	2016/05/14 5:13	66,8 KB
R1-164521.zip	2016/05/14 5:13	63,9 KB
R1-164522.zip	2016/05/14 4:06	77,4 KB
R1-164523.zip	2016/05/14 4:06	57,6 KB
R1-164524.zip	2016/05/14 4:06	32,3 KB
R1-164525.zip	2016/05/14 4:06	91 KB
R1-164526.zip	2016/05/14 4:06	87 KB
R1-164527.zip	2016/05/14 4:08	343,8 KB
R1-164528.zip	2016/05/14 4:08	42,5 KB
R1-164529.zip	2016/05/14 4:06	101,8 KB
R1-164530.zip	2016/05/14 4:08	77,5 KB
R1-164531.zip	2016/05/14 4:08	214 KB
R1-164532.zip	2016/05/30 11:06	4652,1 KB
R1-164533.zip	2016/05/14 5:13	37,1 KB
R1-164534.zip	2016/05/14 5:13	917,1 KB
R1-164535.zip	2016/05/20 17:10	94,4 KB
R1-164536.zip	2016/05/14 5:13	115,5 KB
R1-164537.zip	2016/05/14 5:13	41,6 KB
R1-164538.zip	2016/05/14 5:13	68,7 KB
R1-164540.zip	2016/05/14 5:13	80,3 KB
R1-164541.zip	2016/05/14 4:08	71,6 KB
R1-164542.zip	2016/05/14 4:08	56,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164543.zip	2016/05/14 4:08	41,9 KB
R1-164544.zip	2016/05/14 4:08	38,7 KB
R1-164545.zip	2016/05/14 4:08	537,6 KB
R1-164546.zip	2016/05/14 4:08	255 KB
R1-164547.zip	2016/05/14 4:08	89,9 KB
R1-164548.zip	2016/05/14 4:08	419,3 KB
R1-164549.zip	2016/05/14 4:08	298 KB
R1-164550.zip	2016/05/14 4:09	39,7 KB
R1-164551.zip	2016/05/14 4:09	47,2 KB
R1-164552.zip	2016/05/14 4:09	34,4 KB
R1-164553.zip	2016/05/14 4:09	74,9 KB
R1-164554.zip	2016/05/14 4:09	181,6 KB
R1-164555.zip	2016/05/14 4:09	30,2 KB
R1-164556.zip	2016/05/14 4:09	286,5 KB
R1-164557.zip	2016/05/14 4:09	67,9 KB
R1-164558.zip	2016/05/14 4:09	36,8 KB
R1-164559.zip	2016/05/14 4:09	134,1 KB
R1-164560.zip	2016/05/14 4:09	374,5 KB
R1-164561.zip	2016/05/14 4:09	67 KB
R1-164562.zip	2016/05/14 4:10	2410 KB
R1-164563.zip	2016/05/14 4:10	34,1 KB
R1-164564.zip	2016/05/14 4:10	1134,8 KB
R1-164565.zip	2016/05/14 4:10	157,9 KB
R1-164566.zip	2016/05/18 11:22	73,9 KB
R1-164567.zip	2016/05/14 4:10	62,3 KB
R1-164568.zip	2016/05/14 4:10	106,2 KB
R1-164569.zip	2016/05/14 4:10	39,9 KB
R1-164570.zip	2016/05/14 4:10	44,6 KB
R1-164571.zip	2016/05/14 4:11	264,3 KB
R1-164572.zip	2016/05/13 13:38	63,4 KB
R1-164573.zip	2016/05/13 13:38	24,1 KB
R1-164574.zip	2016/05/13 13:38	54,2 KB
R1-164575.zip	2016/05/13 13:39	82,8 KB
R1-164576.zip	2016/05/13 13:39	851,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164577.zip	2016/05/13 11:42	42,8 KB
R1-164578.zip	2016/05/13 12:14	138 KB
R1-164579.zip	2016/05/13 12:14	127,7 KB
R1-164580.zip	2016/05/13 12:14	87,9 KB
R1-164581.zip	2016/05/13 12:14	67 KB
R1-164582.zip	2016/05/13 12:14	22,5 KB
R1-164583.zip	2016/05/13 12:14	80,3 KB
R1-164584.zip	2016/05/13 12:14	96,5 KB
R1-164585.zip	2016/05/13 12:14	78,5 KB
R1-164586.zip	2016/05/13 12:14	61,3 KB
R1-164587.zip	2016/05/13 12:14	135,3 KB
R1-164588.zip	2016/05/13 12:14	110,2 KB
R1-164589.zip	2016/05/13 12:14	145,6 KB
R1-164590.zip	2016/05/13 12:14	70,7 KB
R1-164591.zip	2016/05/13 12:14	62,2 KB
R1-164592.zip	2016/05/13 12:14	363,6 KB
R1-164593.zip	2016/05/13 17:05	36,6 KB
R1-164594.zip	2016/05/13 17:05	243,4 KB
R1-164595.zip	2016/05/13 13:39	96,4 KB
R1-164596.zip	2016/05/13 13:39	97,7 KB
R1-164597.zip	2016/05/15 6:49	35,3 KB
R1-164598.zip	2016/05/13 13:39	157 KB
R1-164599.zip	2016/05/15 6:49	38,5 KB
R1-164600.zip	2016/05/13 13:39	55,7 KB
R1-164601.zip	2016/05/13 13:39	88,2 KB
R1-164602.zip	2016/05/15 6:49	199,7 KB
R1-164603.zip	2016/05/13 13:39	159,1 KB
R1-164604.zip	2016/05/13 13:39	182,2 KB
R1-164605.zip	2016/05/13 13:45	51,2 KB
R1-164606.zip	2016/05/13 18:49	36,2 KB
R1-164607.zip	2016/05/13 18:49	151,2 KB
R1-164608.zip	2016/05/13 18:49	150 KB
R1-164609.zip	2016/05/13 18:49	138,6 KB
R1-164610.zip	2016/05/13 18:49	133,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164611.zip	2016/05/13 18:49	73,4 KB
R1-164612.zip	2016/05/13 18:49	58,5 KB
R1-164613.zip	2016/05/13 18:49	154,9 KB
R1-164614.zip	2016/05/13 18:49	35,9 KB
R1-164615.zip	2016/05/13 18:49	45,6 KB
R1-164616.zip	2016/05/13 18:49	106,3 KB
R1-164617.zip	2016/05/13 18:49	132,6 KB
R1-164618.zip	2016/05/11 7:44	34 KB
R1-164619.zip	2016/05/11 10:02	821,8 KB
R1-164620.zip	2016/05/11 10:04	174,2 KB
R1-164621.zip	2016/05/13 20:15	1674,3 KB
R1-164622.zip	2016/05/13 20:15	25 KB
R1-164623.zip	2016/05/13 20:15	229,5 KB
R1-164624.zip	2016/05/13 20:15	21,1 KB
R1-164625.zip	2016/05/13 20:15	26 KB
R1-164626.zip	2016/05/13 20:15	20,9 KB
R1-164627.zip	2016/05/13 20:15	36,9 KB
R1-164628.zip	2016/05/13 20:15	54,1 KB
R1-164629.zip	2016/05/13 20:15	157,8 KB
R1-164630.zip	2016/05/13 20:16	172,9 KB
R1-164631.zip	2016/05/13 20:16	21,7 KB
R1-164632.zip	2016/05/13 20:16	22,9 KB
R1-164633.zip	2016/05/13 20:16	25,5 KB
R1-164634.zip	2016/05/13 20:16	22,3 KB
R1-164635.zip	2016/05/11 9:24	291,3 KB
R1-164636.zip	2016/05/13 13:56	167,9 KB
R1-164637.zip	2016/05/14 4:47	313,9 KB
R1-164638.zip	2016/05/14 4:48	530,2 KB
R1-164639.zip	2016/05/14 4:48	163,4 KB
R1-164640.zip	2016/05/14 4:48	484,7 KB
R1-164641.zip	2016/05/14 4:48	121,5 KB
R1-164642.zip	2016/05/14 4:48	1061,6 KB
R1-164643.zip	2016/05/14 4:48	272,4 KB
R1-164644.zip	2016/05/14 4:48	13,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164645.zip	2016/05/13 13:56	81,9 KB
R1-164646.zip	2016/05/13 12:55	116,3 KB
R1-164647.zip	2016/05/13 12:55	42,1 KB
R1-164648.zip	2016/05/13 12:55	72,1 KB
R1-164649.zip	2016/05/13 11:52	63,1 KB
R1-164650.zip	2016/05/13 11:52	57,5 KB
R1-164651.zip	2016/05/13 11:52	98,8 KB
R1-164652.zip	2016/05/13 11:52	75,1 KB
R1-164653.zip	2016/05/13 17:48	178,8 KB
R1-164654.zip	2016/05/13 17:48	17,2 KB
R1-164655.zip	2016/05/13 17:48	573,2 KB
R1-164656.zip	2016/05/13 17:48	36,1 KB
R1-164657.zip	2016/05/13 17:48	67,9 KB
R1-164658.zip	2016/05/13 17:48	42 KB
R1-164659.zip	2016/05/13 17:48	166,7 KB
R1-164660.zip	2016/05/13 17:48	39,9 KB
R1-164661.zip	2016/05/14 5:39	27,7 KB
R1-164662.zip	2016/05/13 21:12	29,6 KB
R1-164663.zip	2016/05/13 7:19	33,2 KB
R1-164664.zip	2016/05/14 1:28	30,6 KB
R1-164665.zip	2016/05/14 1:28	54,9 KB
R1-164666.zip	2016/05/14 1:31	35,1 KB
R1-164667.zip	2016/05/14 1:28	112,3 KB
R1-164668.zip	2016/05/13 19:20	35,7 KB
R1-164669.zip	2016/05/13 17:48	42,6 KB
R1-164670.zip	2016/05/13 17:48	43 KB
R1-164671.zip	2016/05/13 17:48	38,8 KB
R1-164672.zip	2016/05/13 20:16	27,6 KB
R1-164674.zip	2016/05/14 6:05	27,4 KB
R1-164675.zip	2016/05/14 4:30	386,6 KB
R1-164676.zip	2016/05/14 4:30	341,5 KB
R1-164677.zip	2016/05/14 4:30	47,9 KB
R1-164678.zip	2016/05/14 6:02	45,7 KB
R1-164679.zip	2016/05/14 4:30	116,5 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164680.zip	2016/05/14 7:26	48,8 KB
R1-164681.zip	2016/05/14 4:30	30 KB
R1-164682.zip	2016/05/14 4:30	47,8 KB
R1-164683.zip	2016/05/14 4:55	28,4 KB
R1-164684.zip	2016/05/14 5:43	248,2 KB
R1-164685.zip	2016/05/14 5:43	273,6 KB
R1-164686.zip	2016/05/14 5:43	309,2 KB
R1-164687.zip	2016/05/14 4:30	351,1 KB
R1-164688.zip	2016/05/14 5:30	183,8 KB
R1-164689.zip	2016/05/14 4:55	545,8 KB
R1-164690.zip	2016/05/14 5:27	265,9 KB
R1-164691.zip	2016/05/14 5:27	1205,7 KB
R1-164692.zip	2016/05/14 5:27	556,4 KB
R1-164693.zip	2016/05/14 5:27	110,2 KB
R1-164694.zip	2016/05/14 5:33	171,2 KB
R1-164695.zip	2016/05/14 5:17	509,5 KB
R1-164696.zip	2016/05/14 4:30	340,3 KB
R1-164697.zip	2016/05/14 4:19	237,4 KB
R1-164698.zip	2016/05/14 4:19	370,8 KB
R1-164699.zip	2016/05/14 4:19	116,6 KB
R1-164700.zip	2016/05/14 4:19	835,9 KB
R1-164701.zip	2016/05/14 4:19	89,2 KB
R1-164702.zip	2016/05/14 4:19	133,3 KB
R1-164703.zip	2016/05/14 5:04	239 KB
R1-164704.zip	2016/05/14 4:19	175,9 KB
R1-164705.zip	2016/05/14 5:08	47,5 KB
R1-164706.zip	2016/05/14 5:09	38 KB
R1-164707.zip	2016/05/14 4:12	540,3 KB
R1-164708.zip	2016/05/14 4:12	82,4 KB
R1-164709.zip	2016/05/14 6:25	784,5 KB
R1-164710.zip	2016/05/14 6:25	29,9 KB
R1-164711.zip	2016/05/14 5:11	29,9 KB
R1-164712.zip	2016/05/14 4:12	466,4 KB
R1-164713.zip	2016/05/14 4:12	145,3 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164714.zip	2016/05/14 7:29	29,3 KB
R1-164715.zip	2016/05/14 4:12	227,4 KB
R1-164716.zip	2016/05/14 4:12	375,8 KB
R1-164717.zip	2016/05/13 18:22	79,2 KB
R1-164718.zip	2016/05/13 19:28	597,4 KB
R1-164719.zip	2016/05/13 18:22	233,4 KB
R1-164720.zip	2016/05/13 18:22	383,6 KB
R1-164721.zip	2016/05/15 21:22	135,1 KB
R1-164723.zip	2016/05/15 21:22	168,1 KB
R1-164724.zip	2016/05/15 21:22	24,7 KB
R1-164725.zip	2016/05/15 21:22	27,3 KB
R1-164726.zip	2016/05/15 21:22	1267,8 KB
R1-164727.zip	2016/05/15 21:21	417,6 KB
R1-164728.zip	2016/05/15 21:21	73,4 KB
R1-164729.zip	2016/05/15 21:21	39,9 KB
R1-164730.zip	2016/05/15 21:21	63,6 KB
R1-164731.zip	2016/05/15 21:21	28,1 KB
R1-164732.zip	2016/05/15 21:21	568,3 KB
R1-164733.zip	2016/05/13 23:36	47 KB
R1-164734.zip	2016/05/13 21:49	468,2 KB
R1-164735.zip	2016/05/13 7:44	30,8 KB
R1-164736.zip	2016/05/13 7:42	65,8 KB
R1-164737.zip	2016/05/13 7:42	31,2 KB
R1-164738.zip	2016/05/13 23:36	21,3 KB
R1-164739.zip	2016/05/13 23:36	20,3 KB
R1-164740.zip	2016/05/13 23:36	51 KB
R1-164741.zip	2016/05/13 23:36	53,7 KB
R1-164742.zip	2016/05/14 4:30	175,2 KB
R1-164743.zip	2016/05/14 3:28	52 KB
R1-164744.zip	2016/05/14 3:28	77,3 KB
R1-164745.zip	2016/05/13 11:58	293,7 KB
R1-164746.zip	2016/05/14 4:30	308,2 KB
R1-164747.zip	2016/05/13 23:36	56,1 KB
R1-164748.zip	2016/05/13 23:36	53,8 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164749.zip	2016/05/14 4:30	505,1 KB
R1-164750.zip	2016/05/13 15:43	377,7 KB
R1-164751.zip	2016/05/14 4:30	302,7 KB
R1-164752.zip	2016/05/14 4:30	359,5 KB
R1-164753.zip	2016/05/14 3:28	57,7 KB
R1-164754.zip	2016/05/13 19:20	222,3 KB
R1-164755.zip	2016/05/13 10:24	148,4 KB
R1-164756.zip	2016/05/13 19:50	34,7 KB
R1-164757.zip	2016/05/13 20:06	168,4 KB
R1-164758.zip	2016/05/14 4:30	55 KB
R1-164759.zip	2016/05/13 20:41	270,5 KB
R1-164760.zip	2016/05/13 20:57	72,3 KB
R1-164761.zip	2016/05/13 21:17	238,9 KB
R1-164762.zip	2016/05/13 21:24	169,2 KB
R1-164763.zip	2016/05/13 21:34	120,2 KB
R1-164764.zip	2016/05/14 3:18	843,3 KB
R1-164765.zip	2016/05/14 3:18	188,3 KB
R1-164766.zip	2016/05/13 10:50	148,4 KB
R1-164767.zip	2016/05/14 3:18	425,7 KB
R1-164768.zip	2016/05/14 3:19	884,2 KB
R1-164770.zip	2016/05/13 22:55	383,3 KB
R1-164771.zip	2016/05/13 7:42	138,2 KB
R1-164772.zip	2016/05/13 7:42	245,5 KB
R1-164773.zip	2016/05/13 22:55	93,6 KB
R1-164774.zip	2016/05/14 0:43	47,9 KB
R1-164775.zip	2016/05/13 7:45	53,7 KB
R1-164776.zip	2016/05/13 21:49	1929,2 KB
R1-164777.zip	2016/05/13 21:49	293,7 KB
R1-164778.zip	2016/05/13 22:55	134,1 KB
R1-164779.zip	2016/05/13 22:55	280,2 KB
R1-164780.zip	2016/05/13 21:49	469,8 KB
R1-164781.zip	2016/05/13 21:49	358,7 KB
R1-164782.zip	2016/05/13 7:42	38,8 KB
R1-164783.zip	2016/05/13 7:45	134 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164784.zip	2016/05/14 17:37	714,6 KB
R1-164786.zip	2016/05/13 23:36	50,3 KB
R1-164787.zip	2016/05/13 23:36	47,6 KB
R1-164788.zip	2016/05/13 23:36	47,8 KB
R1-164790.zip	2016/05/14 4:30	69,4 KB
R1-164791.zip	2016/05/13 21:49	1049,1 KB
R1-164792.zip	2016/05/13 21:42	119,3 KB
R1-164793.zip	2016/05/14 0:54	147 KB
R1-164794.zip	2016/05/14 0:54	123,4 KB
R1-164795.zip	2016/05/14 0:54	166,5 KB
R1-164796.zip	2016/05/14 0:54	84,7 KB
R1-164797.zip	2016/05/14 0:54	139,8 KB
R1-164798.zip	2016/05/14 0:54	82,5 KB
R1-164799.zip	2016/05/13 20:10	227,2 KB
R1-164800.zip	2016/05/13 6:56	88,5 KB
R1-164801.zip	2016/05/13 20:10	279,4 KB
R1-164802.zip	2016/05/13 19:26	4627,1 KB
R1-164803.zip	2016/05/30 11:05	63,8 KB
R1-164804.zip	2016/05/13 20:20	39,6 KB
R1-164805.zip	2016/05/13 17:16	27,5 KB
R1-164806.zip	2016/05/13 17:16	90,5 KB
R1-164807.zip	2016/05/13 17:16	372,8 KB
R1-164808.zip	2016/05/13 17:16	157,3 KB
R1-164809.zip	2016/05/13 17:16	85,1 KB
R1-164810.zip	2016/05/13 17:16	56,6 KB
R1-164811.zip	2016/05/13 17:16	63 KB
R1-164812.zip	2016/05/14 3:01	3328,7 KB
R1-164813.zip	2016/05/14 3:01	177,1 KB
R1-164814.zip	2016/05/14 2:09	72,7 KB
R1-164815.zip	2016/05/14 2:09	91 KB
R1-164816.zip	2016/05/14 2:09	66,6 KB
R1-164817.zip	2016/05/14 2:09	170,7 KB
R1-164818.zip	2016/05/14 2:09	147,1 KB
R1-164819.zip	2016/05/14 2:09	92,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164820.zip	2016/05/14 2:17	302,5 KB
R1-164821.zip	2016/05/14 2:17	121,5 KB
R1-164822.zip	2016/05/14 2:09	109,3 KB
R1-164823.zip	2016/05/14 2:17	172,3 KB
R1-164824.zip	2016/05/14 2:17	95,6 KB
R1-164825.zip	2016/05/14 2:17	164,8 KB
R1-164826.zip	2016/05/14 2:17	112,7 KB
R1-164827.zip	2016/05/14 2:09	61,6 KB
R1-164828.zip	2016/05/14 2:09	81 KB
R1-164829.zip	2016/05/14 2:09	45,9 KB
R1-164830.zip	2016/05/14 2:09	74 KB
R1-164831.zip	2016/05/14 2:09	85,9 KB
R1-164832.zip	2016/05/14 2:09	56,9 KB
R1-164833.zip	2016/05/14 2:09	43,4 KB
R1-164834.zip	2016/05/14 2:09	91,5 KB
R1-164835.zip	2016/05/14 2:09	37,4 KB
R1-164836.zip	2016/05/14 2:09	59,9 KB
R1-164837.zip	2016/05/14 2:09	28 KB
R1-164838.zip	2016/05/14 2:09	24,8 KB
R1-164839.zip	2016/05/14 2:09	31,3 KB
R1-164840.zip	2016/05/14 2:09	24,7 KB
R1-164841.zip	2016/05/14 2:09	24,6 KB
R1-164842.zip	2016/05/14 2:09	40,6 KB
R1-164843.zip	2016/05/14 2:09	45,9 KB
R1-164844.zip	2016/05/14 2:09	32,1 KB
R1-164845.zip	2016/05/14 2:09	89,4 KB
R1-164846.zip	2016/05/14 2:09	159,4 KB
R1-164847.zip	2016/05/14 2:09	83 KB
R1-164848.zip	2016/05/14 2:09	242,9 KB
R1-164849.zip	2016/05/14 2:09	28,4 KB
R1-164850.zip	2016/05/14 2:08	86,6 KB
R1-164851.zip	2016/05/14 2:08	43,1 KB
R1-164852.zip	2016/05/14 2:08	38 KB
R1-164853.zip	2016/05/14 2:08	36,1 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164854.zip	2016/05/14 2:08	104,7 KB
R1-164855.zip	2016/05/14 2:08	199,9 KB
R1-164856.zip	2016/05/14 2:08	196,5 KB
R1-164857.zip	2016/05/14 2:08	431,4 KB
R1-164858.zip	2016/05/14 2:08	123,2 KB
R1-164859.zip	2016/05/14 2:08	85,7 KB
R1-164860.zip	2016/05/14 2:08	29,7 KB
R1-164861.zip	2016/05/14 2:08	122,9 KB
R1-164862.zip	2016/05/14 2:08	38 KB
R1-164863.zip	2016/05/14 2:08	57,6 KB
R1-164864.zip	2016/05/14 2:17	66,6 KB
R1-164865.zip	2016/05/14 2:17	40,9 KB
R1-164866.zip	2016/05/14 2:08	185 KB
R1-164867.zip	2016/05/14 2:17	162,4 KB
R1-164868.zip	2016/05/14 2:18	476,5 KB
R1-164869.zip	2016/05/13 22:07	125 KB
R1-164870.zip	2016/05/14 3:58	46,7 KB
R1-164871.zip	2016/05/14 2:18	40 KB
R1-164872.zip	2016/05/14 2:18	94,9 KB
R1-164873.zip	2016/05/14 2:18	113,9 KB
R1-164874.zip	2016/05/14 1:28	141,2 KB
R1-164875.zip	2016/05/13 9:46	222,4 KB
R1-164876.zip	2016/05/13 9:46	67,7 KB
R1-164877.zip	2016/05/13 15:53	80,1 KB
R1-164878.zip	2016/05/13 15:53	43,5 KB
R1-164879.zip	2016/05/13 15:53	200,3 KB
R1-164880.zip	2016/05/13 15:53	427,7 KB
R1-164881.zip	2016/05/13 15:53	145 KB
R1-164882.zip	2016/05/13 15:53	156 KB
R1-164883.zip	2016/05/13 15:53	67,8 KB
R1-164884.zip	2016/05/13 15:53	79,1 KB
R1-164885.zip	2016/05/13 15:53	85,5 KB
R1-164886.zip	2016/05/13 15:53	54,7 KB
R1-164887.zip	2016/05/13 15:53	57,9 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164888.zip	2016/05/13 15:53	82,4 KB
R1-164889.zip	2016/05/13 15:53	77,9 KB
R1-164890.zip	2016/05/13 15:53	84,3 KB
R1-164891.zip	2016/05/13 15:53	222,5 KB
R1-164892.zip	2016/05/13 15:53	182,9 KB
R1-164893.zip	2016/05/13 15:53	91,6 KB
R1-164894.zip	2016/05/12 3:23	421,5 KB
R1-164895.zip	2016/05/13 15:28	160,7 KB
R1-164897.zip	2016/05/13 15:22	73,6 KB
R1-164898.zip	2016/05/13 15:23	159,3 KB
R1-164899.zip	2016/05/13 15:23	265,8 KB
R1-164900.zip	2016/05/13 15:23	24,5 KB
R1-164901.zip	2016/05/13 15:23	38 KB
R1-164902.zip	2016/05/13 15:23	130,8 KB
R1-164903.zip	2016/05/13 15:23	25,5 KB
R1-164904.zip	2016/05/13 9:31	21,4 KB
R1-164905.zip	2016/05/13 9:31	108,4 KB
R1-164906.zip	2016/05/13 11:11	73,3 KB
R1-164907.zip	2016/05/13 11:11	82,8 KB
R1-164908.zip	2016/05/13 11:11	66,6 KB
R1-164909.zip	2016/05/13 11:11	117,6 KB
R1-164910.zip	2016/05/13 11:11	90,5 KB
R1-164911.zip	2016/05/13 11:11	102,2 KB
R1-164912.zip	2016/05/13 11:11	117,8 KB
R1-164913.zip	2016/05/13 11:11	75,6 KB
R1-164914.zip	2016/05/13 11:11	62,3 KB
R1-164915.zip	2016/05/13 11:06	79,3 KB
R1-164916.zip	2016/05/13 11:04	22,5 KB
R1-164917.zip	2016/05/13 11:05	64 KB
R1-164918.zip	2016/05/13 20:51	150,4 KB
R1-164919.zip	2016/05/13 13:58	107,1 KB
R1-164920.zip	2016/05/13 13:58	31,3 KB
R1-164921.zip	2016/05/13 13:58	67,7 KB
R1-164922.zip	2016/05/13 13:58	72,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164923.zip	2016/05/13 13:58	95 KB
R1-164924.zip	2016/05/13 13:58	52,3 KB
R1-164925.zip	2016/05/13 9:43	823 KB
R1-164926.zip	2016/05/13 11:55	71,1 KB
R1-164927.zip	2016/05/13 11:55	83,7 KB
R1-164928.zip	2016/05/13 11:55	26,7 KB
R1-164929.zip	2016/05/13 11:55	125,4 KB
R1-164930.zip	2016/05/13 11:55	138 KB
R1-164931.zip	2016/05/13 11:55	49,1 KB
R1-164932.zip	2016/05/13 11:56	1010,8 KB
R1-164933.zip	2016/05/13 11:56	582,5 KB
R1-164934.zip	2016/05/13 11:56	25 KB
R1-164935.zip	2016/05/13 11:56	21,9 KB
R1-164936.zip	2016/05/13 19:49	33,3 KB
R1-164937.zip	2016/05/13 19:49	31,1 KB
R1-164938.zip	2016/05/13 19:49	29,8 KB
R1-164939.zip	2016/05/13 6:24	53,9 KB
R1-164940.zip	2016/05/13 16:56	21,9 KB
R1-164941.zip	2016/05/13 16:57	66 KB
R1-164942.zip	2016/05/13 16:57	77,3 KB
R1-164943.zip	2016/05/13 16:57	17,7 KB
R1-164944.zip	2016/05/13 16:57	13,5 KB
R1-164945.zip	2016/05/13 16:56	21,6 KB
R1-164946.zip	2016/05/13 16:56	20,6 KB
R1-164947.zip	2016/05/13 16:56	63,1 KB
R1-164948.zip	2016/05/13 16:56	61,1 KB
R1-164949.zip	2016/05/13 15:56	43 KB
R1-164950.zip	2016/05/13 14:19	159,2 KB
R1-164951.zip	2016/05/13 14:19	61,8 KB
R1-164952.zip	2016/05/13 14:19	91 KB
R1-164953.zip	2016/05/13 14:19	53,1 KB
R1-164954.zip	2016/05/13 14:19	179,7 KB
R1-164955.zip	2016/05/13 14:19	629,2 KB
R1-164956.zip	2016/05/13 14:19	687,2 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164957.zip	2016/05/13 14:20	1301,8 KB
R1-164958.zip	2016/05/13 15:56	85,1 KB
R1-164959.zip	2016/05/13 15:56	34,3 KB
R1-164960.zip	2016/05/13 15:56	70,5 KB
R1-164961.zip	2016/05/13 15:56	277 KB
R1-164962.zip	2016/05/13 15:56	24,6 KB
R1-164963.zip	2016/05/13 15:56	53,4 KB
R1-164964.zip	2016/05/13 15:56	88,3 KB
R1-164965.zip	2016/05/13 15:56	111,9 KB
R1-164966.zip	2016/05/13 15:56	134,1 KB
R1-164967.zip	2016/05/13 15:56	46,7 KB
R1-164968.zip	2016/05/13 15:57	177,2 KB
R1-164969.zip	2016/05/13 15:57	25,9 KB
R1-164970.zip	2016/05/13 15:57	59,5 KB
R1-164971.zip	2016/05/13 15:57	101,8 KB
R1-164972.zip	2016/05/13 15:57	46,8 KB
R1-164973.zip	2016/05/13 0:47	95,1 KB
R1-164974.zip	2016/05/13 0:47	67,9 KB
R1-164975.zip	2016/05/13 16:16	3728,9 KB
R1-164976.zip	2016/05/13 12:15	41,2 KB
R1-164977.zip	2016/05/13 12:30	178,6 KB
R1-164978.zip	2016/05/13 12:30	1036,8 KB
R1-164979.zip	2016/05/13 12:30	818,3 KB
R1-164980.zip	2016/05/13 12:30	52,1 KB
R1-164981.zip	2016/05/13 12:30	18,8 KB
R1-164982.zip	2016/05/13 12:30	27,8 KB
R1-164983.zip	2016/05/13 9:42	942,9 KB
R1-164984.zip	2016/05/13 15:23	27,5 KB
R1-164985.zip	2016/05/13 11:14	176,8 KB
R1-164986.zip	2016/05/13 14:18	22,9 KB
R1-164987.zip	2016/05/13 14:18	64,2 KB
R1-164988.zip	2016/05/13 14:18	225 KB
R1-164989.zip	2016/05/13 14:18	545,3 KB
R1-164990.zip	2016/05/13 14:18	89,4 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-164991.zip	2016/05/13 21:01	50,1 KB
R1-164992.zip	2016/05/14 2:04	59,4 KB
R1-164993.zip	2016/05/14 2:06	62,7 KB
R1-164994.zip	2016/05/14 2:07	57,9 KB
R1-164995.zip	2016/05/14 2:07	100 KB
R1-164996.zip	2016/05/14 2:08	69,2 KB
R1-164997.zip	2016/05/14 2:08	85,4 KB
R1-164998.zip	2016/05/13 13:08	26,9 KB
R1-164999.zip	2016/05/14 2:08	60,2 KB
R1-165000.zip	2016/05/13 13:08	53,1 KB
R1-165001.zip	2016/05/14 2:09	59,4 KB
R1-165002.zip	2016/05/13 13:08	27,8 KB
R1-165003.zip	2016/05/14 2:10	183,2 KB
R1-165004.zip	2016/05/14 2:13	70,9 KB
R1-165005.zip	2016/05/13 21:39	455,4 KB
R1-165006.zip	2016/05/13 21:39	89,5 KB
R1-165008.zip	2016/05/13 21:39	35,2 KB
R1-165009.zip	2016/05/13 21:36	35,6 KB
R1-165010.zip	2016/05/13 21:36	33,5 KB
R1-165011.zip	2016/05/13 21:36	34,9 KB
R1-165012.zip	2016/05/13 21:36	58,1 KB
R1-165013.zip	2016/05/13 21:36	184,4 KB
R1-165014.zip	2016/05/13 21:36	287,7 KB
R1-165015.zip	2016/05/13 21:36	73,6 KB
R1-165016.zip	2016/05/13 21:36	269,4 KB
R1-165017.zip	2016/05/13 21:36	29,8 KB
R1-165018.zip	2016/05/13 21:36	65,1 KB
R1-165019.zip	2016/05/13 21:37	130,4 KB
R1-165020.zip	2016/05/13 21:37	141,2 KB
R1-165021.zip	2016/05/13 21:37	976 KB
R1-165022.zip	2016/05/13 21:37	34 KB
R1-165023.zip	2016/05/13 21:37	34,5 KB
R1-165024.zip	2016/05/13 21:37	35,4 KB
R1-165025.zip	2016/05/13 21:37	36,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-165026.zip	2016/05/13 21:37	38,9 KB
R1-165027.zip	2016/05/13 21:37	84,4 KB
R1-165028.zip	2016/05/13 21:37	175,1 KB
R1-165029.zip	2016/05/13 21:37	214,4 KB
R1-165030.zip	2016/05/13 21:37	67,1 KB
R1-165031.zip	2016/05/13 21:37	104,9 KB
R1-165032.zip	2016/05/13 11:58	22,1 KB
R1-165033.zip	2016/05/13 11:59	153,8 KB
R1-165034.zip	2016/05/13 11:59	21,4 KB
R1-165035.zip	2016/05/13 20:23	1668,8 KB
R1-165036.zip	2016/05/14 5:47	117 KB
R1-165037.zip	2016/05/14 8:32	65,1 KB
R1-165038.zip	2016/05/14 8:32	200,7 KB
R1-165039.zip	2016/05/13 18:51	46,1 KB
R1-165040.zip	2016/05/13 18:51	77,7 KB
R1-165041.zip	2016/05/13 23:03	164,6 KB
R1-165042.zip	2016/05/13 23:03	82,8 KB
R1-165043.zip	2016/05/13 23:03	94,5 KB
R1-165044.zip	2016/05/13 23:03	48,5 KB
R1-165045.zip	2016/05/13 23:03	31 KB
R1-165046.zip	2016/05/13 23:03	56,9 KB
R1-165047.zip	2016/05/13 21:23	30,8 KB
R1-165048.zip	2016/05/13 21:23	72,1 KB
R1-165049.zip	2016/05/13 21:23	61,5 KB
R1-165050.zip	2016/05/13 21:23	31,1 KB
R1-165051.zip	2016/05/13 21:23	148,4 KB
R1-165052.zip	2016/05/13 21:23	62,7 KB
R1-165053.zip	2016/05/14 5:06	299,3 KB
R1-165054.zip	2016/05/13 8:34	46,4 KB
R1-165055.zip	2016/05/14 5:06	65,2 KB
R1-165056.zip	2016/05/14 1:10	282,8 KB
R1-165057.zip	2016/05/14 3:18	1026,9 KB
R1-165058.zip	2016/05/14 3:19	171,5 KB
R1-165059.zip	2016/05/14 4:09	364 KB

Petitioners' Exhibit 1007, p. 1797
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165060.zip	2016/05/14 4:09	170,6 KB
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R1-165062.zip	2016/05/14 3:19	165,6 KB
R1-165063.zip	2016/05/14 3:19	157,5 KB
R1-165064.zip	2016/05/14 3:19	117,3 KB
R1-165065.zip	2016/05/14 3:19	1008,4 KB
R1-165066.zip	2016/05/13 8:23	46,4 KB
R1-165067.zip	2016/05/13 8:23	21,3 KB
R1-165068.zip	2016/05/13 10:12	26,4 KB
R1-165069.zip	2016/05/13 10:12	24,7 KB
R1-165070.zip	2016/05/14 6:47	488,7 KB
R1-165071.zip	2016/05/14 6:47	60,8 KB
R1-165072.zip	2016/05/14 6:48	377,9 KB
R1-165073.zip	2016/05/14 6:48	519,5 KB
R1-165074.zip	2016/05/14 6:48	152 KB
R1-165075.zip	2016/05/14 6:48	160,3 KB
R1-165076.zip	2016/05/14 6:48	1231,9 KB
R1-165077.zip	2016/05/14 6:48	616,4 KB
R1-165078.zip	2016/05/14 6:48	125 KB
R1-165079.zip	2016/05/14 6:48	409,5 KB
R1-165080.zip	2016/05/14 1:57	33,4 KB
R1-165081.zip	2016/05/14 1:57	36 KB
R1-165082.zip	2016/05/14 1:57	31,2 KB
R1-165083.zip	2016/05/14 6:28	180,8 KB
R1-165084.zip	2016/05/14 3:43	79,1 KB
R1-165085.zip	2016/05/14 3:43	68,7 KB
R1-165086.zip	2016/05/14 3:43	31,7 KB
R1-165087.zip	2016/05/14 3:43	31 KB
R1-165088.zip	2016/05/14 3:43	31,6 KB
R1-165089.zip	2016/05/14 3:43	31,2 KB
R1-165090.zip	2016/05/14 3:43	32 KB
R1-165091.zip	2016/05/14 3:43	292 KB
R1-165092.zip	2016/05/14 3:43	98,9 KB
R1-165093.zip	2016/05/13 9:13	29,5 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-165097.zip	2016/05/14 5:40	322,3 KB
R1-165098.zip	2016/05/14 5:40	123,5 KB
R1-165099.zip	2016/05/14 5:40	91,3 KB
R1-165100.zip	2016/05/14 5:40	96,5 KB
R1-165101.zip	2016/05/14 5:40	79,5 KB
R1-165102.zip	2016/05/14 5:40	39,9 KB
R1-165103.zip	2016/05/14 6:12	75,7 KB
R1-165104.zip	2016/05/14 5:50	281,9 KB
R1-165105.zip	2016/05/14 5:46	77 KB
R1-165106.zip	2016/05/14 5:46	19,4 KB
R1-165107.zip	2016/05/14 4:56	20,5 KB
R1-165108.zip	2016/05/14 4:57	20,4 KB
R1-165109.zip	2016/05/14 4:57	37,1 KB
R1-165110.zip	2016/05/14 4:57	40,8 KB
R1-165111.zip	2016/05/14 4:57	163,9 KB
R1-165112.zip	2016/05/14 5:54	890,8 KB
R1-165113.zip	2016/05/13 10:55	90,9 KB
R1-165114.zip	2016/05/13 10:54	468,5 KB
R1-165115.zip	2016/05/14 4:20	197 KB
R1-165116.zip	2016/05/14 0:18	49,8 KB
R1-165117.zip	2016/05/14 0:18	110,6 KB
R1-165118.zip	2016/05/14 0:18	250,5 KB
R1-165119.zip	2016/05/14 0:18	230,3 KB
R1-165120.zip	2016/05/14 0:18	220,4 KB
R1-165121.zip	2016/05/14 0:18	43,9 KB
R1-165123.zip	2016/05/14 0:18	94 KB
R1-165124.zip	2016/05/14 1:04	148,4 KB
R1-165125.zip	2016/05/14 1:04	53,1 KB
R1-165126.zip	2016/05/14 1:04	138,7 KB
R1-165127.zip	2016/05/14 1:04	85,9 KB
R1-165128.zip	2016/05/14 1:04	34,3 KB

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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-165131.zip	2016/05/14 1:04	72,6 KB
R1-165132.zip	2016/05/14 1:04	165,9 KB
R1-165133.zip	2016/05/14 1:04	191,6 KB
R1-165134.zip	2016/05/14 1:04	12,8 KB
R1-165135.zip	2016/05/13 17:41	66,2 KB
R1-165136.zip	2016/05/13 17:41	444,8 KB
R1-165137.zip	2016/05/13 17:41	21,6 KB
R1-165138.zip	2016/05/13 17:41	387,2 KB
R1-165139.zip	2016/05/14 3:08	46,5 KB
R1-165140.zip	2016/05/13 14:18	87,4 KB
R1-165141.zip	2016/05/14 5:56	106,3 KB
R1-165142.zip	2016/05/14 5:56	76,5 KB
R1-165143.zip	2016/05/14 5:57	334,8 KB
R1-165144.zip	2016/05/14 5:57	499,7 KB
R1-165145.zip	2016/05/14 5:57	48,4 KB
R1-165146.zip	2016/05/14 5:57	145,3 KB
R1-165147.zip	2016/05/14 6:16	37,9 KB
R1-165148.zip	2016/05/14 5:57	53,2 KB
R1-165149.zip	2016/05/14 5:57	250 KB
R1-165150.zip	2016/05/14 5:57	76,3 KB
R1-165151.zip	2016/05/14 5:56	570,9 KB
R1-165152.zip	2016/05/14 5:56	630 KB
R1-165154.zip	2016/05/14 5:56	45,3 KB
R1-165155.zip	2016/05/14 5:56	42 KB
R1-165156.zip	2016/05/14 5:56	61,1 KB
R1-165157.zip	2016/05/14 5:56	62,3 KB
R1-165158.zip	2016/05/14 5:56	109,4 KB
R1-165159.zip	2016/05/14 5:56	115,4 KB
R1-165160.zip	2016/05/14 5:40	44,1 KB
R1-165161.zip	2016/05/14 5:11	212,5 KB
R1-165162.zip	2016/05/14 5:11	33,2 KB
R1-165163.zip	2016/05/14 5:11	183 KB

Petitioners' Exhibit 1007, p. 1800
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165164.zip	2016/05/16 2:21	250,7 KB
R1-165165.zip	2016/05/14 5:11	457,8 KB
R1-165166.zip	2016/05/14 5:11	35,8 KB
R1-165167.zip	2016/05/14 5:11	83,3 KB
R1-165168.zip	2016/05/14 5:05	45,1 KB
R1-165169.zip	2016/05/13 9:33	89,1 KB
R1-165170.zip	2016/05/14 1:40	92,3 KB
R1-165171.zip	2016/05/14 4:53	50,4 KB
R1-165172.zip	2016/05/14 1:40	185,1 KB
R1-165173.zip	2016/05/14 1:40	2801,3 KB
R1-165174.zip	2016/05/14 1:40	126,5 KB
R1-165175.zip	2016/05/14 1:40	403,1 KB
R1-165176.zip	2016/05/14 4:53	274,7 KB
R1-165177.zip	2016/05/14 4:53	463,2 KB
R1-165178.zip	2016/05/14 4:53	149,9 KB
R1-165179.zip	2016/05/14 1:59	120,1 KB
R1-165180.zip	2016/05/14 1:59	151 KB
R1-165181.zip	2016/05/14 1:59	165,8 KB
R1-165182.zip	2016/05/14 3:02	65,9 KB
R1-165183.zip	2016/05/13 12:06	87,9 KB
R1-165184.zip	2016/05/14 1:59	87,7 KB
R1-165185.zip	2016/05/14 3:02	235,9 KB
R1-165186.zip	2016/05/14 3:02	70,6 KB
R1-165187.zip	2016/05/14 3:02	51,4 KB
R1-165188.zip	2016/05/14 3:02	116 KB
R1-165189.zip	2016/05/14 3:02	167,7 KB
R1-165190.zip	2016/05/14 3:02	80,7 KB
R1-165191.zip	2016/05/14 1:40	48,8 KB
R1-165192.zip	2016/05/14 1:40	128,8 KB
R1-165193.zip	2016/05/14 1:40	71,3 KB
R1-165194.zip	2016/05/14 1:40	41,8 KB
R1-165195.zip	2016/05/14 1:40	50,4 KB
R1-165196.zip	2016/05/14 1:40	44,6 KB
R1-165197.zip	2016/05/14 1:40	33,1 KB

Petitioners' Exhibit 1007, p. 1801
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165198.zip	2016/05/14 1:40	143 KB
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R1-165200.zip	2016/05/14 1:59	120,1 KB
R1-165201.zip	2016/05/14 1:59	345,6 KB
R1-165202.zip	2016/05/14 1:59	134,7 KB
R1-165203.zip	2016/05/14 1:59	119,8 KB
R1-165204.zip	2016/05/14 1:41	43,4 KB
R1-165205.zip	2016/05/14 1:41	469,9 KB
R1-165206.zip	2016/05/14 1:41	82,8 KB
R1-165207.zip	2016/05/14 1:40	69,4 KB
R1-165208.zip	2016/05/14 1:40	69,2 KB
R1-165209.zip	2016/05/15 21:31	66,9 KB
R1-165210.zip	2016/05/14 4:04	92,7 KB
R1-165211.zip	2016/05/14 4:05	82,2 KB
R1-165212.zip	2016/05/14 4:48	506,6 KB
R1-165213.zip	2016/05/14 4:48	72,7 KB
R1-165214.zip	2016/05/14 4:48	67,7 KB
R1-165215.zip	2016/05/14 4:48	343,3 KB
R1-165216.zip	2016/05/14 1:40	30,1 KB
R1-165217.zip	2016/05/13 11:58	53,8 KB
R1-165218.zip	2016/05/13 11:12	181,1 KB
R1-165219.zip	2016/05/14 5:43	33,5 KB
R1-165220.zip	2016/05/14 5:43	28,8 KB
R1-165221.zip	2016/05/14 5:43	22,2 KB
R1-165222.zip	2016/05/14 5:43	19,7 KB
R1-165223.zip	2016/05/14 5:43	19,4 KB
R1-165224.zip	2016/05/14 6:48	51,2 KB
R1-165225.zip	2016/05/14 6:48	12,3 KB
R1-165226.zip	2016/05/14 6:49	69,9 KB
R1-165228.zip	2016/05/14 6:49	56,9 KB
R1-165229.zip	2016/05/14 6:49	63,2 KB
R1-165230.zip	2016/05/14 6:49	53,3 KB
R1-165231.zip	2016/05/14 6:49	54,8 KB
R1-165232.zip	2016/05/14 6:49	50,5 KB

Petitioners' Exhibit 1007, p. 1802
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165233.zip	2016/05/14 6:49	25,9 KB
R1-165234.zip	2016/05/14 6:49	252,8 KB
R1-165235.zip	2016/05/13 15:27	31,1 KB
R1-165236.zip	2016/05/13 18:12	53,3 KB
R1-165237.zip	2016/05/13 18:12	102,2 KB
R1-165238.zip	2016/05/13 18:12	166,6 KB
R1-165239.zip	2016/05/14 6:30	42,9 KB
R1-165240.zip	2016/05/14 9:30	90,1 KB
R1-165241.zip	2016/05/14 7:14	32,8 KB
R1-165242.zip	2016/05/14 6:30	57,4 KB
R1-165243.zip	2016/05/13 23:38	210,6 KB
R1-165244.zip	2016/05/13 23:38	119,3 KB
R1-165245.zip	2016/05/13 23:38	207,3 KB
R1-165246.zip	2016/05/13 23:38	81,8 KB
R1-165247.zip	2016/05/13 15:32	39,1 KB
R1-165248.zip	2016/05/13 15:32	57,2 KB
R1-165249.zip	2016/05/14 4:28	21,5 KB
R1-165250.zip	2016/05/13 15:32	194,9 KB
R1-165251.zip	2016/05/14 5:27	106,7 KB
R1-165252.zip	2016/05/14 5:28	234,5 KB
R1-165253.zip	2016/05/14 5:28	60,2 KB
R1-165254.zip	2016/05/13 23:38	80,5 KB
R1-165255.zip	2016/05/13 23:38	77,7 KB
R1-165256.zip	2016/05/13 13:58	25,8 KB
R1-165257.zip	2016/05/13 10:52	209 KB
R1-165258.zip	2016/05/13 23:38	110,9 KB
R1-165259.zip	2016/05/13 23:38	74,8 KB
R1-165260.zip	2016/05/13 23:38	75,6 KB
R1-165261.zip	2016/05/13 21:37	1066,6 KB
R1-165262.zip	2016/05/13 23:38	132,9 KB
R1-165263.zip	2016/05/13 23:39	158 KB
R1-165264.zip	2016/05/13 23:39	93,8 KB
R1-165265.zip	2016/05/13 10:22	38,5 KB
R1-165266.zip	2016/05/13 23:39	162 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-165268.zip	2016/05/13 23:39	81,5 KB
R1-165269.zip	2016/05/13 10:22	34,5 KB
R1-165270.zip	2016/05/13 23:39	20,7 KB
R1-165271.zip	2016/05/13 23:39	76,4 KB
R1-165272.zip	2016/05/13 23:39	119,2 KB
R1-165273.zip	2016/05/13 23:39	117,3 KB
R1-165274.zip	2016/05/13 23:39	111,1 KB
R1-165275.zip	2016/05/13 23:39	78,8 KB
R1-165276.zip	2016/05/13 23:39	307,8 KB
R1-165277.zip	2016/05/13 23:39	175,3 KB
R1-165278.zip	2016/05/13 10:14	29,9 KB
R1-165279.zip	2016/05/13 10:14	16,8 KB
R1-165280.zip	2016/05/13 10:14	27,8 KB
R1-165281.zip	2016/05/13 10:14	29,2 KB
R1-165282.zip	2016/05/13 10:14	25,1 KB
R1-165283.zip	2016/05/13 10:14	25 KB
R1-165284.zip	2016/05/14 1:40	419 KB
R1-165285.zip	2016/05/13 15:27	499,5 KB
R1-165286.zip	2016/05/13 15:54	481,5 KB
R1-165287.zip	2016/05/13 15:55	43,3 KB
R1-165288.zip	2016/05/13 15:55	48,8 KB
R1-165289.zip	2016/05/14 3:42	32 KB
R1-165290.zip	2016/05/13 15:55	533,6 KB
R1-165291.zip	2016/05/13 15:55	16,3 KB
R1-165292.zip	2016/05/13 18:44	20,8 KB
R1-165293.zip	2016/05/13 18:44	50,5 KB
R1-165294.zip	2016/05/13 18:44	73,5 KB
R1-165295.zip	2016/05/13 18:44	32,1 KB
R1-165296.zip	2016/05/13 18:44	47,1 KB
R1-165297.zip	2016/05/13 18:44	28,3 KB
R1-165298.zip	2016/05/13 18:44	90,2 KB
R1-165299.zip	2016/05/13 18:44	45,7 KB
R1-165300.zip	2016/05/13 18:44	20 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-165302.zip	2016/05/13 18:44	40,3 KB
R1-165303.zip	2016/05/13 18:44	66,5 KB
R1-165304.zip	2016/05/13 18:44	483 KB
R1-165305.zip	2016/05/13 18:44	19,9 KB
R1-165306.zip	2016/05/13 17:48	42 KB
R1-165307.zip	2016/05/13 19:28	93,5 KB
R1-165308.zip	2016/05/13 16:35	54,3 KB
R1-165309.zip	2016/05/13 15:22	109,5 KB
R1-165310.zip	2016/05/13 12:05	258,3 KB
R1-165311.zip	2016/05/13 12:06	45,5 KB
R1-165312.zip	2016/05/16 12:25	105,1 KB
R1-165313.zip	2016/05/13 13:01	72,9 KB
R1-165314.zip	2016/05/13 13:03	37,7 KB
R1-165315.zip	2016/05/13 15:41	119 KB
R1-165316.zip	2016/05/14 5:42	159,9 KB
R1-165317.zip	2016/05/13 23:39	175,8 KB
R1-165318.zip	2016/05/14 5:37	66,2 KB
R1-165319.zip	2016/05/13 20:16	22,3 KB
R1-165320.zip	2016/05/13 20:16	77 KB
R1-165321.zip	2016/05/13 20:16	77,8 KB
R1-165322.zip	2016/05/13 20:16	195,9 KB
R1-165323.zip	2016/05/14 5:37	35,8 KB
R1-165324.zip	2016/05/14 5:37	45,3 KB
R1-165325.zip	2016/05/13 21:41	2066,5 KB
R1-165326.zip	2016/05/13 21:41	1808,1 KB
R1-165327.zip	2016/05/13 21:41	33,1 KB
R1-165328.zip	2016/05/13 21:41	29,5 KB
R1-165329.zip	2016/05/13 21:41	3842,7 KB
R1-165330.zip	2016/05/13 21:41	32,6 KB
R1-165331.zip	2016/05/13 21:41	30,3 KB
R1-165332.zip	2016/05/13 21:41	34,7 KB
R1-165333.zip	2016/05/13 21:42	42,2 KB
R1-165334.zip	2016/05/13 21:42	60,6 KB

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IPR2024-01121

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R1-165337.zip	2016/05/13 21:42	19,2 KB
R1-165338.zip	2016/05/13 21:42	15,7 KB
R1-165339.zip	2016/05/13 21:42	15,6 KB
R1-165340.zip	2016/05/13 13:59	51,4 KB
R1-165341.zip	2016/05/14 4:54	58,7 KB
R1-165342.zip	2016/05/13 13:59	140,1 KB
R1-165343.zip	2016/05/13 20:39	231,4 KB
R1-165344.zip	2016/05/13 20:39	249,5 KB
R1-165345.zip	2016/05/13 20:39	233,2 KB
R1-165346.zip	2016/05/13 20:39	495,3 KB
R1-165347.zip	2016/05/13 20:39	243,4 KB
R1-165348.zip	2016/05/13 20:39	275,1 KB
R1-165349.zip	2016/05/13 20:39	346,5 KB
R1-165350.zip	2016/05/13 20:39	750,5 KB
R1-165351.zip	2016/05/13 23:30	35,5 KB
R1-165352.zip	2016/05/13 20:40	634,8 KB
R1-165353.zip	2016/05/13 20:40	1518,3 KB
R1-165354.zip	2016/05/13 20:40	357,4 KB
R1-165355.zip	2016/05/14 4:48	46,2 KB
R1-165356.zip	2016/05/13 21:37	33,1 KB
R1-165357.zip	2016/05/13 21:38	730,5 KB
R1-165358.zip	2016/05/13 21:38	2773,7 KB
R1-165359.zip	2016/05/13 21:38	87 KB
R1-165360.zip	2016/05/13 21:38	62,3 KB
R1-165361.zip	2016/05/13 21:38	63,7 KB
R1-165362.zip	2016/05/13 21:38	70,9 KB
R1-165363.zip	2016/05/13 21:38	234,9 KB
R1-165364.zip	2016/05/13 21:39	186,9 KB
R1-165365.zip	2016/05/13 21:39	167 KB
R1-165366.zip	2016/05/13 21:39	201,8 KB
R1-165367.zip	2016/05/14 8:06	25,3 KB
R1-165370.zip	2016/05/14 5:05	11,7 KB

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sort by name/desc	sort by date/desc	sort by size/desc
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R1-165373.zip	2016/05/13 21:39	33,5 KB
R1-165374.zip	2016/05/13 21:39	29,7 KB
R1-165375.zip	2016/05/13 21:39	109 KB
R1-165376.zip	2016/05/13 21:39	35,8 KB
R1-165377.zip	2016/05/13 21:39	117,9 KB
R1-165378.zip	2016/05/13 21:39	246,6 KB
R1-165379.zip	2016/05/13 21:39	79,4 KB
R1-165380.zip	2016/05/13 21:39	33 KB
R1-165381.zip	2016/05/13 21:39	91,6 KB
R1-165382.zip	2016/05/14 5:42	10,7 KB
R1-165383.zip	2016/05/14 6:53	22,4 KB
R1-165385.zip	2016/05/14 5:42	39,1 KB
R1-165386.zip	2016/05/14 5:42	27 KB
R1-165387.zip	2016/05/14 5:57	28,6 KB
R1-165388.zip	2016/05/14 5:42	81,2 KB
R1-165389.zip	2016/05/14 5:42	59,2 KB
R1-165390.zip	2016/05/14 5:42	25,9 KB
R1-165392.zip	2016/05/14 5:42	60,6 KB
R1-165393.zip	2016/05/14 5:42	27 KB
R1-165394.zip	2016/05/14 5:42	59,2 KB
R1-165395.zip	2016/05/14 5:42	28,5 KB
R1-165396.zip	2016/05/13 23:40	60,7 KB
R1-165397.zip	2016/05/13 16:11	45,4 KB
R1-165398.zip	2016/05/15 21:18	385,3 KB
R1-165400.zip	2016/05/19 6:53	91,1 KB
R1-165401.zip	2016/05/16 20:17	881,6 KB
R1-165402.zip	2016/05/18 8:34	340,5 KB
R1-165403.zip	2016/05/20 17:10	1014 KB
R1-165404.zip	2016/05/17 8:18	449,2 KB
R1-165405.zip	2016/05/19 6:53	197,5 KB
R1-165406.zip	2016/05/30 11:05	51,8 KB
R1-165407.zip	2016/05/30 11:05	86,9 KB

Petitioners' Exhibit 1007, p. 1807
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165408.zip	2016/05/19 6:53	422,7 KB
R1-165409.zip	2016/05/18 10:30	1022,3 KB
R1-165410.zip	2016/05/20 8:39	44 KB
R1-165411.zip	2016/05/20 8:39	52,1 KB
R1-165412.zip	2016/05/20 8:39	40,1 KB
R1-165413.zip	2016/05/18 15:55	16,9 KB
R1-165414.zip	2016/05/18 12:13	12 KB
R1-165415.zip	2016/05/18 12:13	9,6 KB
R1-165416.zip	2016/05/19 11:35	99,4 KB
R1-165417.zip	2016/05/18 16:07	80,3 KB
R1-165418.zip	2016/05/19 7:35	760,8 KB
R1-165419.zip	2016/05/20 8:39	134,5 KB
R1-165420.zip	2016/05/20 17:04	93 KB
R1-165421.zip	2016/05/19 20:03	20,9 KB
R1-165422.zip	2016/05/21 16:41	989,4 KB
R1-165423.zip	2016/05/20 8:39	193,9 KB
R1-165424.zip	2016/05/20 8:38	34 KB
R1-165425.zip	2016/05/22 15:36	493,8 KB
R1-165426.zip	2016/05/22 15:36	2038,7 KB
R1-165427.zip	2016/05/20 8:38	89,2 KB
R1-165428.zip	2016/05/20 17:04	388,3 KB
R1-165429.zip	2016/05/20 17:04	97,6 KB
R1-165430.zip	2016/05/20 17:04	420,3 KB
R1-165431.zip	2016/05/20 17:04	170,2 KB
R1-165432.zip	2016/05/30 11:05	122,8 KB
R1-165433.zip	2016/05/22 1:45	116,3 KB
R1-165434.zip	2016/05/22 1:44	283 KB
R1-165435.zip	2016/05/20 17:04	144,3 KB
R1-165436.zip	2016/05/30 11:05	79,2 KB
R1-165437.zip	2016/05/30 11:05	49,3 KB
R1-165438.zip	2016/05/30 11:05	20,5 KB
R1-165439.zip	2016/05/30 11:05	473,9 KB
R1-165440.zip	2016/05/21 16:41	27,5 KB
R1-165441.zip	2016/05/21 16:41	58,1 KB

Petitioners' Exhibit 1007, p. 1808
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165442.zip	2016/05/22 7:07	18,4 KB
R1-165443.zip	2016/05/30 11:05	246,9 KB
R1-165444.zip	2016/05/30 11:05	159,4 KB
R1-165445.zip	2016/05/30 11:05	45,7 KB
R1-165446.zip	2016/05/22 1:44	31,3 KB
R1-165447.zip	2016/05/30 11:05	57,8 KB
R1-165448.zip	2016/05/22 15:24	1110,3 KB
R1-165449.zip	2016/05/22 8:04	211,7 KB
R1-165450.zip	2016/05/30 10:04	52,3 KB
R1-165451.zip	2016/05/30 10:04	38,2 KB
R1-165452.zip	2016/05/30 10:04	12,7 KB
R1-165453.zip	2016/05/30 10:04	333,9 KB
R1-165454.zip	2016/05/30 10:04	427,4 KB
R1-165455.zip	2016/05/30 10:04	906 KB
R1-165456.zip	2016/05/30 10:04	343,4 KB
R1-165457.zip	2016/05/30 12:02	34 KB
R1-165460.zip	2016/05/30 10:03	33,2 KB
R1-165461.zip	2016/05/30 10:03	31,4 KB
R1-165462.zip	2016/05/30 10:03	240 KB
R1-165463.zip	2016/05/30 10:03	28,1 KB
R1-165464.zip	2016/05/30 10:03	47,8 KB
R1-165465.zip	2016/05/30 10:03	1176,5 KB
R1-165466.zip	2016/05/30 10:03	33,2 KB
R1-165467.zip	2016/05/30 10:03	17,4 KB
R1-165468.zip	2016/05/30 10:03	544,8 KB
R1-165469.zip	2016/05/30 10:03	58,2 KB
R1-165470.zip	2016/05/30 10:03	354,2 KB
R1-165471.zip	2016/05/30 10:03	62,2 KB
R1-165474.zip	2016/05/30 10:03	55,2 KB
R1-165475.zip	2016/05/30 10:03	39,8 KB
R1-165476.zip	2016/05/30 10:03	40,3 KB
R1-165477.zip	2016/05/30 10:03	182,9 KB
R1-165478.zip	2016/05/30 10:03	172,3 KB
R1-165479.zip	2016/05/30 10:03	107,4 KB

Petitioners' Exhibit 1007, p. 1809
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165480.zip	2016/05/30 10:03	49,5 KB
R1-165481.zip	2016/05/30 10:03	1543,9 KB
R1-165482.zip	2016/05/30 10:03	53,3 KB
R1-165483.zip	2016/05/30 10:03	655,2 KB
R1-165484.zip	2016/05/30 10:03	115 KB
R1-165485.zip	2016/05/30 10:03	39,4 KB
R1-165487.zip	2016/05/30 10:03	35,1 KB
R1-165488.zip	2016/05/30 10:03	134 KB
R1-165490.zip	2016/05/30 10:02	142 KB
R1-165491.zip	2016/05/30 10:02	96,5 KB
R1-165492.zip	2016/05/30 10:02	39,7 KB
R1-165493.zip	2016/05/30 10:02	22,1 KB
R1-165494.zip	2016/05/30 10:02	15,3 KB
R1-165495.zip	2016/05/30 10:02	17,7 KB
R1-165496.zip	2016/05/30 10:02	16,4 KB
R1-165498.zip	2016/05/30 10:02	43,3 KB
R1-165499.zip	2016/05/30 10:02	49,7 KB
R1-165507.zip	2016/05/30 10:02	33,9 KB
R1-165508.zip	2016/05/30 10:03	2769,3 KB
R1-165509.zip	2016/05/30 10:02	76 KB
R1-165510.zip	2016/05/30 10:02	32,8 KB
R1-165511.zip	2016/05/30 10:02	12,8 KB
R1-165512.zip	2016/05/30 10:02	9,5 KB
R1-165513.zip	2016/05/30 10:02	75,1 KB
R1-165514.zip	2016/06/08 13:36	3185,9 KB
R1-165515.zip	2016/05/30 10:02	15,7 KB
R1-165516.zip	2016/05/30 10:02	15,3 KB
R1-165517.zip	2016/05/30 10:02	94,8 KB
R1-165518.zip	2016/05/30 10:02	402,5 KB
R1-165519.zip	2016/05/30 10:02	161,7 KB
R1-165520.zip	2016/05/30 10:02	1546,6 KB
R1-165521.zip	2016/05/30 10:02	166,7 KB
R1-165522.zip	2016/05/30 10:02	37,5 KB
R1-165523.zip	2016/05/30 10:02	42,5 KB

Petitioners' Exhibit 1007, p. 1810
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sort by name/desc	sort by date/desc	sort by size/desc
R1-165524.zip	2016/05/30 10:02	44 KB
R1-165525.zip	2016/05/30 10:02	49,4 KB
R1-165526.zip	2016/05/30 10:02	58,4 KB
R1-165527.zip	2016/05/30 10:01	220,4 KB
R1-165528.zip	2016/05/30 10:01	461 KB
R1-165529.zip	2016/05/30 10:01	39,8 KB
R1-165530.zip	2016/05/30 10:01	45,2 KB
R1-165531.zip	2016/05/30 10:01	52,1 KB
R1-165532.zip	2016/05/30 10:01	31,2 KB
R1-165533.zip	2016/05/30 10:01	43,4 KB
R1-165534.zip	2016/06/01 8:57	35,5 KB
R1-165535.zip	2016/05/30 10:01	62,8 KB
R1-165536.zip	2016/05/30 10:01	61,5 KB
R1-165537.zip	2016/05/30 10:01	22,2 KB
R1-165538.zip	2016/05/30 10:01	19,9 KB
R1-165539.zip	2016/05/30 10:01	47,6 KB
R1-165540.zip	2016/05/30 10:01	27 KB
R1-165541.zip	2016/05/30 10:01	39,6 KB
R1-165542.zip	2016/05/30 10:01	34,7 KB
R1-165543.zip	2016/05/30 10:01	38,5 KB
R1-165544.zip	2016/05/30 10:01	57,3 KB
R1-165545.zip	2016/05/30 10:01	37,3 KB
R1-165546.zip	2016/05/30 10:01	38,8 KB
R1-165547.zip	2016/05/30 10:01	40,3 KB
R1-165548.zip	2016/05/30 10:01	103,4 KB
R1-165549.zip	2016/05/30 10:01	43 KB
R1-165550.zip	2016/05/30 10:01	43,5 KB
R1-165551.zip	2016/05/30 10:01	40,5 KB
R1-165552.zip	2016/05/30 10:01	29,1 KB
R1-165553.zip	2016/05/30 10:01	42,8 KB
R1-165554.zip	2016/05/30 10:01	46,9 KB
R1-165555.zip	2016/05/30 10:01	161 KB
R1-165556.zip	2016/05/30 10:01	31,2 KB
R1-165557.zip	2016/05/30 10:01	32,9 KB

Petitioners' Exhibit 1007, p. 1811
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165558.zip	2016/05/30 10:01	28,4 KB
R1-165559.zip	2016/05/30 10:01	49 KB
R1-165561.zip	2016/05/30 10:01	55 KB
R1-165562.zip	2016/05/30 10:01	36,9 KB
R1-165563.zip	2016/05/30 10:01	48,5 KB
R1-165564.zip	2016/05/30 10:01	149,9 KB
R1-165565.zip	2016/05/30 10:01	31,3 KB
R1-165566.zip	2016/05/30 10:01	29,5 KB
R1-165567.zip	2016/05/30 10:01	29,7 KB
R1-165568.zip	2016/05/30 10:01	28,5 KB
R1-165569.zip	2016/05/30 10:01	30,3 KB
R1-165570.zip	2016/05/30 10:01	572,5 KB
R1-165571.zip	2016/05/30 10:01	42,6 KB
R1-165572.zip	2016/05/30 10:01	41,9 KB
R1-165573.zip	2016/05/30 10:01	55,3 KB
R1-165575.zip	2016/05/30 10:01	41,3 KB
R1-165576.zip	2016/05/30 10:01	176 KB
R1-165578.zip	2016/05/30 10:01	112,2 KB
R1-165579.zip	2016/05/30 10:01	37,6 KB
R1-165580.zip	2016/05/30 10:01	284,5 KB
R1-165581.zip	2016/05/30 10:01	319,8 KB
R1-165583.zip	2016/05/30 10:01	112,8 KB
R1-165584.zip	2016/05/30 10:01	292,6 KB
R1-165585.zip	2016/05/30 10:01	62,2 KB
R1-165586.zip	2016/05/30 10:01	24,9 KB
R1-165587.zip	2016/05/30 10:01	217,5 KB
R1-165588.zip	2016/05/30 10:01	255 KB
R1-165589.zip	2016/05/30 10:00	36,5 KB
R1-165590.zip	2016/05/30 10:00	39,9 KB
R1-165591.zip	2016/05/30 10:00	99,3 KB
R1-165592.zip	2016/05/30 10:00	74,2 KB
R1-165593.zip	2016/05/30 10:00	44,8 KB
R1-165594.zip	2016/05/30 10:00	58,8 KB
R1-165595.zip	2016/05/30 10:00	57,3 KB

Petitioners' Exhibit 1007, p. 1812
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IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165596.zip	2016/05/30 10:00	56,2 KB
R1-165597.zip	2016/05/30 10:00	246,4 KB
R1-165598.zip	2016/05/30 10:00	52,1 KB
R1-165599.zip	2016/05/30 10:00	1040,8 KB
R1-165600.zip	2016/05/30 10:00	243,1 KB
R1-165601.zip	2016/05/30 10:00	257,1 KB
R1-165602.zip	2016/05/30 10:00	30,6 KB
R1-165603.zip	2016/05/30 10:00	44,4 KB
R1-165604.zip	2016/05/30 10:00	47,7 KB
R1-165605.zip	2016/05/30 10:00	392,6 KB
R1-165606.zip	2016/05/30 10:00	51,7 KB
R1-165607.zip	2016/05/30 10:00	32,9 KB
R1-165608.zip	2016/05/30 10:00	38,5 KB
R1-165609.zip	2016/05/30 10:00	43,3 KB
R1-165610.zip	2016/05/30 10:00	42,6 KB
R1-165611.zip	2016/05/30 10:00	43,8 KB
R1-165612.zip	2016/05/30 10:00	94,8 KB
R1-165613.zip	2016/05/30 10:00	38,9 KB
R1-165614.zip	2016/05/30 10:00	46,4 KB
R1-165615.zip	2016/05/30 10:00	35,9 KB
R1-165616.zip	2016/05/30 10:00	46,1 KB
R1-165617.zip	2016/05/30 10:00	49,3 KB
R1-165618.zip	2016/05/30 10:00	56,1 KB
R1-165619.zip	2016/05/30 10:00	386,3 KB
R1-165620.zip	2016/05/30 10:00	361,9 KB
R1-165621.zip	2016/05/30 10:00	20,4 KB
R1-165622.zip	2016/05/30 10:00	20,9 KB
R1-165623.zip	2016/05/30 10:00	37,2 KB
R1-165624.zip	2016/05/30 10:00	50,8 KB
R1-165625.zip	2016/05/30 10:00	32,3 KB
R1-165626.zip	2016/05/30 10:00	79,8 KB
R1-165627.zip	2016/05/30 10:00	26,7 KB
R1-165628.zip	2016/05/30 10:00	44,6 KB
R1-165629.zip	2016/05/30 10:00	55,6 KB

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sort by name/desc	sort by date/desc	sort by size/desc
R1-165630.zip	2016/05/30 10:00	31,2 KB
R1-165631.zip	2016/05/30 10:00	43,6 KB
R1-165632.zip	2016/05/30 10:00	164,2 KB
R1-165633.zip	2016/05/30 10:00	46,5 KB
R1-165634.zip	2016/05/30 10:00	46,9 KB
R1-165635.zip	2016/05/30 10:00	29,9 KB
R1-165636.zip	2016/05/30 10:00	16,8 KB
R1-165637.zip	2016/05/30 10:00	49,9 KB
R1-165638.zip	2016/05/30 10:00	32 KB
R1-165639.zip	2016/05/30 10:00	55,8 KB
R1-165640.zip	2016/05/30 10:00	217,4 KB
R1-165641.zip	2016/05/30 10:00	81,2 KB
R1-165642.zip	2016/05/30 10:00	50,4 KB
R1-165643.zip	2016/05/30 9:59	51,9 KB
R1-165644.zip	2016/05/30 9:59	36,4 KB
R1-165645.zip	2016/05/30 9:59	34,1 KB
R1-165646.zip	2016/05/30 9:59	35,1 KB
R1-165647.zip	2016/05/30 9:59	37,1 KB
R1-165648.zip	2016/05/30 9:59	47 KB
R1-165649.zip	2016/05/30 9:59	29,5 KB
R1-165650.zip	2016/05/30 9:59	34,8 KB
R1-165651.zip	2016/05/30 9:59	60,5 KB
R1-165652.zip	2016/05/30 9:59	48,2 KB
R1-165653.zip	2016/05/30 9:59	335,4 KB
R1-165654.zip	2016/05/30 9:59	52 KB
R1-165655.zip	2016/05/30 9:59	281,3 KB
R1-165656.zip	2016/05/30 9:59	32,6 KB
R1-165657.zip	2016/05/30 9:59	33,2 KB
R1-165658.zip	2016/05/30 9:59	58,2 KB
R1-165660.zip	2016/05/30 9:59	53,1 KB
R1-165662.zip	2016/05/30 9:59	37,3 KB
R1-165663.zip	2016/05/30 9:59	50 KB
R1-165664.zip	2016/05/30 9:59	53,3 KB
R1-165665.zip	2016/05/30 9:59	225,7 KB

Petitioners' Exhibit 1007, p. 1814
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sort by name/desc	sort by date/desc	sort by size/desc
R1-165666.zip	2016/05/30 9:59	60,3 KB
R1-165667.zip	2016/05/30 9:59	276,6 KB
R1-165668.zip	2016/05/30 9:59	780 KB
R1-165669.zip	2016/05/30 9:59	43,3 KB
R1-165670.zip	2016/05/30 9:59	93,8 KB
R1-165671.zip	2016/05/30 9:59	40,9 KB
R1-165672.zip	2016/05/30 9:59	36 KB
R1-165673.zip	2016/05/30 9:59	33,5 KB
R1-165674.zip	2016/05/30 9:59	90,1 KB
R1-165675.zip	2016/05/30 9:59	210,5 KB
R1-165676.zip	2016/05/30 9:59	37,2 KB
R1-165677.zip	2016/05/30 9:59	36,8 KB
R1-165678.zip	2016/05/30 9:59	37,4 KB
R1-165679.zip	2016/05/30 9:59	37,1 KB
R1-165680.zip	2016/05/30 9:59	37,1 KB
R1-165681.zip	2016/05/30 9:59	38 KB
R1-165682.zip	2016/05/30 9:59	35,1 KB
R1-165683.zip	2016/05/30 9:59	90,3 KB
R1-165684.zip	2016/05/30 9:59	39,1 KB
R1-165685.zip	2016/05/30 9:59	798,7 KB
R1-165686.zip	2016/05/30 9:59	116,1 KB
R1-165687.zip	2016/05/30 9:59	37,5 KB
R1-165688.zip	2016/05/30 9:59	43,2 KB
R1-165690.zip	2016/05/30 9:59	52,5 KB
R1-165691.zip	2016/05/30 9:59	77,1 KB
R1-165692.zip	2016/05/30 9:59	52,7 KB
R1-165693.zip	2016/05/30 9:59	40,6 KB
R1-165694.zip	2016/05/30 9:59	22,5 KB
R1-165695.zip	2016/05/30 9:59	14,9 KB
R1-165696.zip	2016/05/30 9:59	51,1 KB
R1-165697.zip	2016/05/30 9:59	47,3 KB
R1-165698.zip	2016/05/30 9:59	57,3 KB
R1-165699.zip	2016/05/30 9:59	50,8 KB
R1-165700.zip	2016/05/30 9:59	93,3 KB

Petitioners' Exhibit 1007, p. 1815
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sort by name/desc	sort by date/desc	sort by size/desc
R1-165701.zip	2016/05/30 9:58	40,9 KB
R1-165702.zip	2016/05/30 9:58	53 KB
R1-165703.zip	2016/06/01 19:11	40,9 KB
R1-165704.zip	2016/05/30 9:58	75 KB
R1-165705.zip	2016/05/30 9:58	1575,7 KB
R1-165706.zip	2016/05/30 9:58	168,7 KB
R1-165707.zip	2016/05/30 9:58	48,1 KB
R1-165708.zip	2016/05/30 9:58	30,5 KB
R1-165709.zip	2016/05/30 9:58	33 KB
R1-165710.zip	2016/05/30 9:58	22,3 KB
R1-165711.zip	2016/05/30 9:58	271,1 KB
R1-165712.zip	2016/05/30 9:58	276,6 KB
R1-165713.zip	2016/05/30 9:58	54,5 KB
R1-165714.zip	2016/05/30 9:58	45,6 KB
R1-165715.zip	2016/05/30 9:58	52,2 KB
R1-165716.zip	2016/05/30 9:58	61,4 KB
R1-165717.zip	2016/05/30 9:58	142,6 KB
R1-165718.zip	2016/05/30 9:58	45,3 KB
R1-165719.zip	2016/05/30 9:58	459,5 KB
R1-165720.zip	2016/05/30 9:58	16,7 KB
R1-165721.zip	2016/05/30 9:58	59,1 KB
R1-165722.zip	2016/05/30 9:58	12,4 KB
R1-165723.zip	2016/05/30 9:58	13,4 KB
R1-165724.zip	2016/05/30 9:58	21 KB
R1-165725.zip	2016/05/30 9:58	403 KB
R1-165726.zip	2016/05/30 9:58	42,3 KB
R1-165727.zip	2016/05/30 9:58	18,5 KB
R1-165728.zip	2016/05/30 9:58	38,5 KB
R1-165729.zip	2016/05/30 9:58	45 KB
R1-165730.zip	2016/05/30 9:58	19 KB
R1-165731.zip	2016/05/30 9:58	33,3 KB
R1-165732.zip	2016/05/30 9:58	82,9 KB
R1-165733.zip	2016/05/30 9:58	45,8 KB
R1-165734.zip	2016/05/30 9:58	454,4 KB

Petitioners' Exhibit 1007, p. 1816
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165735.zip	2016/05/30 9:58	207,7 KB
R1-165736.zip	2016/05/30 9:58	304,5 KB
R1-165737.zip	2016/05/30 9:58	37,2 KB
R1-165739.zip	2016/05/30 9:58	91,2 KB
R1-165740.zip	2016/05/30 9:58	47,3 KB
R1-165741.zip	2016/05/30 9:58	43,6 KB
R1-165742.zip	2016/05/30 9:58	56,1 KB
R1-165743.zip	2016/05/30 9:58	60,6 KB
R1-165744.zip	2016/05/30 9:58	59,8 KB
R1-165745.zip	2016/05/30 9:57	58,6 KB
R1-165746.zip	2016/05/30 9:57	32,2 KB
R1-165747.zip	2016/05/30 9:57	45,3 KB
R1-165748.zip	2016/05/30 9:57	10,4 KB
R1-165749.zip	2016/05/30 9:57	54,8 KB
R1-165750.zip	2016/05/30 9:57	9,8 KB
R1-165752.zip	2016/05/30 9:57	29,2 KB
R1-165753.zip	2016/05/30 9:57	14,6 KB
R1-165754.zip	2016/05/30 9:57	16,5 KB
R1-165755.zip	2016/05/30 9:57	49 KB
R1-165756.zip	2016/05/30 9:57	26,9 KB
R1-165757.zip	2016/05/30 9:57	27,5 KB
R1-165758.zip	2016/05/30 9:57	24,5 KB
R1-165759.zip	2016/05/30 9:57	57,8 KB
R1-165760.zip	2016/05/30 9:57	39,9 KB
R1-165761.zip	2016/05/30 9:57	39,2 KB
R1-165762.zip	2016/05/30 9:57	39,3 KB
R1-165763.zip	2016/05/30 9:57	31,1 KB
R1-165764.ZIP	2016/05/30 9:57	38,1 KB
R1-165765.ZIP	2016/05/30 9:57	36,9 KB
R1-165766.zip	2016/05/30 9:57	9,3 KB
R1-165767.zip	2016/05/30 9:57	30,6 KB
R1-165768.zip	2016/05/30 9:57	1672,3 KB
R1-165769.zip	2016/05/30 9:57	251,7 KB
R1-165770.zip	2016/05/30 9:57	35,7 KB

Petitioners' Exhibit 1007, p. 1817
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165771.zip	2016/05/30 9:57	40,5 KB
R1-165772.zip	2016/05/30 9:57	27,7 KB
R1-165773.zip	2016/05/30 9:57	147,2 KB
R1-165774.zip	2016/05/30 9:57	194,6 KB
R1-165775.zip	2016/05/30 9:57	35,4 KB
R1-165783.zip	2016/05/30 9:57	52,4 KB
R1-165784.zip	2016/05/30 9:57	45,8 KB
R1-165785.zip	2016/06/14 12:05	5546,2 KB
R1-165786.zip	2016/06/14 12:04	1090,5 KB
R1-165787.zip	2016/06/14 12:04	2908,6 KB
R1-165788.zip	2016/05/30 9:57	95,6 KB
R1-165789.zip	2016/05/30 9:57	336,8 KB
R1-165790.zip	2016/05/30 9:57	48 KB
R1-165791.zip	2016/05/30 9:57	30,3 KB
R1-165792.zip	2016/05/30 9:57	41,3 KB
R1-165793.zip	2016/05/30 9:57	49,8 KB
R1-165794.zip	2016/05/30 9:57	48,3 KB
R1-165795.zip	2016/05/30 9:57	61,6 KB
R1-165796.zip	2016/05/30 9:57	49,3 KB
R1-165797.zip	2016/05/30 9:57	162,6 KB
R1-165798.zip	2016/05/30 9:57	166 KB
R1-165799.zip	2016/05/30 9:56	53,3 KB
R1-165800.zip	2016/05/30 9:56	79,1 KB
R1-165801.zip	2016/05/30 9:56	47,6 KB
R1-165802.zip	2016/05/30 9:56	39,3 KB
R1-165803.zip	2016/05/30 9:56	44,2 KB
R1-165804.zip	2016/05/30 9:56	60,5 KB
R1-165805.zip	2016/05/30 9:56	17,7 KB
R1-165806.zip	2016/05/30 9:56	37,1 KB
R1-165807.zip	2016/05/30 9:56	197,8 KB
R1-165808.zip	2016/05/30 9:56	25,1 KB
R1-165809.zip	2016/05/30 9:56	160,2 KB
R1-165810.zip	2016/05/30 9:57	6678,3 KB
R1-165811.zip	2016/05/30 9:56	32,4 KB

Petitioners' Exhibit 1007, p. 1818
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165812.zip	2016/05/30 9:56	43,3 KB
R1-165814.zip	2016/05/30 9:56	9,9 KB
R1-165815.zip	2016/05/30 9:55	33 KB
R1-165816.zip	2016/05/30 9:55	44,9 KB
R1-165817.zip	2016/05/30 9:55	26,2 KB
R1-165818.zip	2016/05/30 9:55	39,1 KB
R1-165819.zip	2016/05/30 9:55	13,9 KB
R1-165820.zip	2016/05/30 9:55	17,2 KB
R1-165821.zip	2016/05/30 9:55	67,9 KB
R1-165822.zip	2016/08/10 13:07	31,6 KB
R1-165824.zip	2016/05/30 9:55	30,3 KB
R1-165825.zip	2016/05/30 9:55	37,2 KB
R1-165826.zip	2016/05/30 9:55	56,3 KB
R1-165827.zip	2016/05/30 9:55	93,1 KB
R1-165828.zip	2016/05/30 9:55	8,7 KB
R1-165829.zip	2016/05/30 9:55	160,6 KB
R1-165830.zip	2016/05/30 9:55	45,5 KB
R1-165831.zip	2016/05/30 9:55	47,7 KB
R1-165832.zip	2016/05/30 9:55	40 KB
R1-165833.zip	2016/05/30 9:55	270,5 KB
R1-165834.zip	2016/05/30 9:54	29,2 KB
R1-165835.zip	2016/05/30 9:54	20,1 KB
R1-165836.zip	2016/05/30 9:55	6689,5 KB
R1-165837.zip	2016/05/30 9:54	34,6 KB
R1-165838.zip	2016/05/30 9:54	14,1 KB
R1-165839.zip	2016/05/30 9:54	19 KB
R1-165840.zip	2016/05/30 9:54	102,3 KB
R1-165841.zip	2016/05/30 9:54	52,1 KB
R1-165842.zip	2016/05/30 9:54	294,1 KB
R1-165843.zip	2016/05/30 9:54	39,3 KB
R1-165844.zip	2016/05/30 9:54	47,8 KB
R1-165845.zip	2016/05/30 9:54	301 KB
R1-165846.zip	2016/05/30 9:53	49,4 KB
R1-165847.zip	2016/05/30 9:53	70,8 KB

Petitioners' Exhibit 1007, p. 1819
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165848.zip	2016/05/30 9:53	51,6 KB
R1-165849.zip	2016/05/30 9:53	38,9 KB
R1-165850.zip	2016/05/30 9:53	219,8 KB
R1-165851.zip	2016/05/30 9:53	51,2 KB
R1-165852.zip	2016/05/30 9:53	64,2 KB
R1-165853.zip	2016/05/30 9:53	20,1 KB
R1-165854.zip	2016/05/30 9:53	46,2 KB
R1-165855.zip	2016/05/30 9:53	159,1 KB
R1-165856.zip	2016/05/30 9:54	6692,4 KB
R1-165857.zip	2016/05/30 9:53	53 KB
R1-165858.zip	2016/05/30 9:53	67,9 KB
R1-165859.zip	2016/05/30 9:53	59,9 KB
R1-165860.zip	2016/05/30 9:53	23 KB
R1-165862.zip	2016/05/30 9:53	32,7 KB
R1-165863.zip	2016/05/30 9:53	32,7 KB
R1-165865.zip	2016/05/30 9:53	66,9 KB
R1-165866.zip	2016/06/08 13:35	3184,2 KB
R1-165867.zip	2016/05/30 9:53	59,3 KB
R1-165868.zip	2016/05/30 9:53	27,2 KB
R1-165869.zip	2016/05/30 9:53	24,6 KB
R1-165870.zip	2016/05/30 9:53	20,6 KB
R1-165871.zip	2016/05/30 9:53	197,9 KB
R1-165872.zip	2016/05/30 9:53	65,8 KB
R1-165873.zip	2016/05/30 9:53	41,8 KB
R1-165874.zip	2016/05/30 9:53	42,7 KB
R1-165875.zip	2016/06/08 13:34	71,1 KB
R1-165876.zip	2016/05/30 9:53	561,5 KB
R1-165877.zip	2016/05/30 9:53	38,7 KB
R1-165878.zip	2016/05/30 9:53	45,9 KB
R1-165879.zip	2016/05/30 9:53	27,4 KB
R1-165880.zip	2016/05/30 9:53	33,4 KB
R1-165881.zip	2016/05/30 9:53	36,9 KB
R1-165882.zip	2016/05/30 9:53	61 KB
R1-165883.zip	2016/05/30 9:53	30,3 KB

Petitioners' Exhibit 1007, p. 1820
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165884.zip	2016/05/30 9:53	52,3 KB
R1-165885.zip	2016/05/30 9:53	67,9 KB
R1-165886.zip	2016/05/30 9:53	67,4 KB
R1-165887.zip	2016/06/03 7:05	44 KB
R1-165888.zip	2016/05/30 9:53	15,8 KB
R1-165889.zip	2016/06/02 10:53	63 KB
R1-165890.zip	2016/08/10 13:07	26,9 KB
R1-165891.zip	2016/05/30 9:53	68,7 KB
R1-165892.zip	2016/05/30 9:53	47,9 KB
R1-165893.zip	2016/05/30 9:52	155,2 KB
R1-165894.zip	2016/05/30 9:52	32,2 KB
R1-165895.zip	2016/05/30 9:52	19,9 KB
R1-165896.zip	2016/05/30 9:52	62,5 KB
R1-165897.zip	2016/08/22 18:39	50 KB
R1-165898.zip	2016/05/30 9:52	33,4 KB
R1-165899.zip	2016/05/30 9:52	37,5 KB
R1-165900.zip	2016/05/30 9:52	58,5 KB
R1-165901.zip	2016/05/30 9:52	58 KB
R1-165902.zip	2016/05/30 9:52	39,5 KB
R1-165903.zip	2016/05/30 9:52	47,3 KB
R1-165904.zip	2016/05/30 9:52	37,5 KB
R1-165905.zip	2016/05/30 9:52	82,1 KB
R1-165906.zip	2016/05/30 9:52	32,9 KB
R1-165907.zip	2016/05/30 9:52	61 KB
R1-165908.zip	2016/05/30 9:52	38,5 KB
R1-165909.zip	2016/05/30 9:51	319,8 KB
R1-165910.zip	2016/05/30 9:51	573,3 KB
R1-165913.zip	2016/05/30 9:53	6702,2 KB
R1-165914.zip	2016/05/30 9:51	41,2 KB
R1-165915.zip	2016/05/30 9:51	25,1 KB
R1-165916.zip	2016/05/30 9:51	38,8 KB
R1-165917.zip	2016/05/30 9:51	39,4 KB
R1-165918.zip	2016/05/30 9:51	70 KB
R1-165919.zip	2016/05/30 9:51	40,2 KB

Petitioners' Exhibit 1007, p. 1821
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165920.zip	2016/05/30 9:51	47,4 KB
R1-165921.zip	2016/05/30 9:51	39,8 KB
R1-165922.zip	2016/05/30 9:51	40,6 KB
R1-165923.zip	2016/05/30 9:51	99,2 KB
R1-165924.zip	2016/05/30 9:51	40,7 KB
R1-165925.zip	2016/05/30 9:51	67,1 KB
R1-165926.zip	2016/05/30 9:51	92 KB
R1-165927.zip	2016/05/30 9:51	201,9 KB
R1-165928.zip	2016/05/30 9:51	543,8 KB
R1-165929.zip	2016/05/30 9:51	41,9 KB
R1-165930.zip	2016/05/30 9:51	44,3 KB
R1-165931.zip	2016/05/30 9:51	38,2 KB
R1-165932.zip	2016/05/30 9:51	107,5 KB
R1-165933.zip	2016/05/30 9:51	212,8 KB
R1-165934.zip	2016/05/30 9:51	99 KB
R1-165935.zip	2016/05/30 9:51	99,9 KB
R1-165936.zip	2016/05/30 9:51	112,2 KB
R1-165937.zip	2016/05/30 9:51	98,4 KB
R1-165938.zip	2016/05/30 9:51	80,7 KB
R1-165939.zip	2016/05/30 9:51	94,1 KB
R1-165940.zip	2016/05/30 9:51	93,9 KB
R1-165941.zip	2016/05/30 9:51	87,1 KB
R1-165942.zip	2016/05/30 9:51	112 KB
R1-165943.zip	2016/05/30 9:51	94,6 KB
R1-165944.zip	2016/05/30 9:51	399 KB
R1-165945.zip	2016/05/30 9:51	98,2 KB
R1-165946.zip	2016/05/30 9:51	42,9 KB
R1-165947.zip	2016/05/30 9:51	34,3 KB
R1-165948.zip	2016/05/30 9:50	51,8 KB
R1-165949.zip	2016/05/30 9:50	44,8 KB
R1-165950.zip	2016/05/30 9:50	41,3 KB
R1-165951.zip	2016/05/30 9:50	94,1 KB
R1-165952.zip	2016/05/30 9:50	56,3 KB
R1-165953.zip	2016/05/30 9:50	44,3 KB

Petitioners' Exhibit 1007, p. 1822
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-165954.zip	2016/05/30 9:50	122,2 KB
R1-165955.zip	2016/05/30 9:50	45,3 KB
R1-165956.zip	2016/05/30 9:50	48,3 KB
R1-165957.zip	2016/05/30 9:50	54,3 KB
R1-165958.zip	2016/05/30 9:50	27,3 KB
R1-165959.zip	2016/05/30 9:50	45,2 KB
R1-165960.zip	2016/05/30 9:50	37,6 KB
R1-165962.zip	2016/05/30 9:50	71,6 KB
R1-165963.zip	2016/06/08 11:46	584,3 KB
R1-165964.zip	2016/06/08 13:16	30,1 KB
R1-165965.zip	2016/06/03 12:38	23,4 KB
R1-165966.zip	2016/06/08 13:16	1717,4 KB
R1-165967.zip	2016/06/09 8:43	10744,3 KB
R1-165968.zip	2016/06/08 13:16	27,5 KB
R1-165969.zip	2016/06/09 6:45	27,5 KB
R1-165970.zip	2016/06/08 13:16	1434,8 KB
R1-165971.zip	2016/06/09 6:45	589,2 KB
R1-165972.zip	2016/06/10 13:08	168,1 KB
R1-165973.zip	2016/06/09 8:20	29,9 KB
R1-165974.zip	2016/08/12 13:07	5156,2 KB
R1-165975.zip	2016/08/12 13:06	22702,6 KB
R1-165977.zip	2016/08/11 15:52	200,3 KB
R1-165978.zip	2016/08/11 15:52	77 KB
R1-165979.zip	2016/08/12 9:11	66,4 KB
R1-165982.zip	2016/05/30 9:50	41,3 KB
R1-165984.zip	2016/05/30 9:50	15,8 KB
R1-165985.zip	2016/05/30 9:50	36,7 KB
R1-165986.zip	2016/05/30 9:50	13,2 KB
R1-165987.zip	2016/05/30 9:50	32,7 KB
R1-165988.zip	2016/05/30 9:50	27,9 KB
R1-165989.zip	2016/05/30 9:50	61,2 KB
R1-165990.zip	2016/05/30 9:50	33,1 KB
R1-165991.zip	2016/05/30 9:50	36,7 KB
R1-165992.zip	2016/05/30 9:50	46,3 KB

Petitioners' Exhibit 1007, p. 1823
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
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R1-165996.zip	2016/05/30 9:50	13,6 KB
R1-165997.zip	2016/05/30 9:50	24,2 KB
R1-165998.zip	2016/05/30 9:50	30,8 KB
R1-165999.zip	2016/05/30 9:50	26,2 KB
R1-166000.zip	2016/05/30 9:50	41,7 KB
R1-166001.zip	2016/05/30 9:50	55,7 KB
R1-166002.zip	2016/05/30 9:50	40,3 KB
R1-166003.zip	2016/05/30 9:50	40,5 KB
R1-166004.zip	2016/05/30 9:50	13,6 KB
R1-166005.zip	2016/05/30 9:50	37,3 KB
R1-166006.zip	2016/05/30 9:50	57,7 KB
R1-166007.zip	2016/05/30 9:50	40,9 KB
R1-166008.zip	2016/05/30 9:50	37,6 KB
R1-166009.zip	2016/05/30 9:50	46,4 KB
R1-166010.zip	2016/05/30 9:50	51,7 KB
R1-166011.zip	2016/05/30 9:50	41,3 KB
R1-166012.zip	2016/05/30 9:50	67,6 KB
R1-166013.zip	2016/05/30 9:50	45,3 KB
R1-166014.zip	2016/05/30 9:50	51,2 KB
R1-166015.zip	2016/05/30 9:50	42,9 KB
R1-166016.zip	2016/05/30 9:50	49,7 KB
R1-166017.zip	2016/05/30 9:50	17,3 KB
R1-166019.zip	2016/05/30 9:50	34,9 KB
R1-166020.zip	2016/05/30 9:50	42,6 KB
R1-166021.zip	2016/05/30 9:50	34,6 KB
R1-166022.zip	2016/05/30 9:50	36,6 KB
R1-166023.zip	2016/05/30 9:50	37,8 KB
R1-166024.zip	2016/05/30 9:50	46,3 KB
R1-166025.zip	2016/05/30 9:50	26,9 KB
R1-166026.zip	2016/05/30 9:50	34,8 KB
R1-166027.zip	2016/05/30 9:50	31,8 KB
R1-166028.zip	2016/05/30 9:50	41,7 KB

Petitioners' Exhibit 1007, p. 1824
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

sort by name/desc	sort by date/desc	sort by size/desc
R1-166029.zip	2016/06/08 13:37	21,2 KB
R1-166030.zip	2016/05/30 9:50	24,5 KB
R1-166031.zip	2016/05/30 9:50	42,6 KB
R1-166032.zip	2016/05/30 9:50	67,6 KB
R1-166033.zip	2016/05/30 9:50	15,2 KB
R1-166034.zip	2016/05/30 9:50	17,3 KB
R1-166035.zip	2016/05/30 9:50	42,9 KB
R1-166036.zip	2016/05/30 9:50	46,4 KB
R1-166037.zip	2016/05/30 9:50	46,3 KB
R1-166038.zip	2016/05/30 9:50	9,4 KB
R1-166039.zip	2016/05/30 9:50	32,3 KB
R1-166040.zip	2016/05/30 9:50	30,9 KB
R1-166041.zip	2016/05/30 9:50	26,4 KB
R1-166042.zip	2016/05/30 9:50	45,7 KB
R1-166043.zip	2016/06/07 10:23	28,9 KB
R1-166044.zip	2016/06/07 10:23	17,3 KB
R1-166045.zip	2016/06/09 6:51	106,1 KB
R1-166046.zip	2016/06/09 8:07	19,6 KB
R1-166047.zip	2016/06/09 8:07	19,4 KB
R1-166048.zip	2016/06/10 13:08	32,6 KB
R1-166049.zip	2016/08/11 6:38	37,3 KB
R1-166050.zip	2016/08/10 13:07	13,1 KB
R1-166051.zip	2016/08/10 13:07	87,4 KB
R1-166052.zip	2016/08/16 7:35	51,9 KB
R1-166053.zip	2016/08/12 13:56	13,5 KB
TDoc_List_Meeting_RAN1#85.xlsm	2017/01/16 0:32	485,1 KB
TDoc_List_Meeting_RAN1#85.xlsx	2022/01/10 15:29	477,7 KB
TDoc_List_Meeting_RAN1#85.zip	2018/01/10 16:44	862,3 KB

2030 items.

Petitioners' Exhibit 1007, p. 1825
AT&T et al v. Asustek Technology & Celerity
IPR2024-01121

APPENDIX 34

3GPP_TSG_RAN_WG1 Archives
June 2016, Week 1

3GPP_TSG_RAN_WG1@LIST.ETSI.ORG

Options: Use Monospaced Font
Show Text Part by Default
Show All Mail Headers

Message: [<< First] [< Prev] [Next >] [Last >>]
Topic: [<< First] [< Prev] [Next >] [Last >>]
Author: [<< First] [< Prev] [Next >] [Last >>]

Subject: [RAN1#85]: Post meeting minutes
From: Patrick Merias <[log in to unmask]>
Reply To: Patrick Merias <[log in to unmask]>
Date: Fri, 3 Jun 2016 12:23:13 +0000
Content-Type: multipart/mixed
Parts/Attachments: text/plain (1630 bytes) , text/html (9 kB) ,
Draft_Minutes_report_RAN1#85_v010.zip (948 kB)

Dear all,

First apologizes for the late posting… first draft of the minutes from Nanjing is attached and can also be downloaded from portal @/tsg_ran/WG1_RL1/TSGR1_85/Report
This version is far from being a clean one as I mainly focused myself on:

- Outputs to others WG and TSG
- Agreed CRs checking
- NR

My plan is now on checking the LTE part and update 3GU with all the LTE-related decisions made last week.
More urgently, short term will be devoted in the preparation to the upcoming plenary…
Any feedback/comment is welcome
BR/P

From: Patrick Merias
Sent: 30 May 2016 2:09 PM
To: 3GPP_TSG_RAN_WG1 <[log in to unmask]>
Subject: [RAN1#85]: Tdocs upload post meeting

Dear all,

Hope you all enjoy a peaceful journey back home…
All available Tdocs (at least those I have) have been uploaded to /tsg_ran/WG1_RL1/TSGR1_85/Docs
I have now started to check the… almost 2000 docs – consequently don't be surprised if all decisions made are not yet properly reflected in 3GU Tdoc list – I work on it !!
BR/P

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ATOM RSS1 RSS2

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APPENDIX 35

3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Source:	**MCC Support**
Title:	**Draft Report of 3GPP TSG RAN WG1 #85 v0.1.0 (Nanjing,China, 23rd – 27th May 2016)**
Document for:	**Comments**



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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Main facts summary

3GPP TSG WG RAN1 #85 meeting, hosted by the Chinese Friends of 3GPP, was held at Shangri-La Hotel Nanjing, China.
The meeting started at 9:00 on Monday 23rd May and finished at 17:10 on Friday 27th May 2016.
The number of attending delegates, having signed the participants' paper list, was **xxx.**

The schedule of the week was as follows:

- Monday: Common session on Agenda items 1, 2, 3, 4, 5, 7.1.2 (Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers), 7.1.3 (Maintenance of Release 13 LAA) and 7.1.4 (Maintenance of Release 13 EB/FD-MIMO) followed by Study on Latency reduction techniques (AI 7.3.10.1 on Evaluation results, AI 7.3.10.2 on Channel design for shortened TTI)
- Monday afternoon (LTE)
  - Session on NB-IoT (AI 7.2.1) chaired by Matthew Baker.

- Tuesday (NR): chaired by Satoshi Nagata
- Tuesday (LTE session1): chaired by Matthew Baker
  - eMBMS enhancements for LTE (AI 7.3.5), SRS Carrier Based Switching for LTE (AI 7.3.6) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Tuesday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (and possibly other CRs (e.g., LAA, MIMO, eCA), Further Indoor Positioning enhancements for UTRA and LTE (AI 7.3.7), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Tuesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Tuesday (HSPA): Multi-Carrier enhancements for UMTS (AI 6.2) chaired by Carmela Cozzo from Huawei.

- Wednesday (NR): chaired by Satoshi Nagata
- Wednesday (LTE session1): chaired by Matthew Baker
  - Rel-13 CRs Maintenance (AI 7.1), Uplink Capacity Enhancements for LTE (AI 7.3.8), Study on Latency reduction techniques (AI 7.3.10) and Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3).
- Wednesday (LTE session2): chaired by Wanshi Chen
  - Support for V2V services based on LTE sidelink (AI 7.3.2), Study on LTE-based V2X Services (AI 7.3.9) and Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1).
- Wednesday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia followed by session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.
- Wednesday (HSPA): DTX/DRX enhancements in CELL_FACH (AI 6.3) chaired by Florent Munier from Ericsson followed by Maintenance.

- Thursday (NR): chaired by Satoshi Nagata
- Thursday (LTE session1): chaired by Matthew Baker
  - Rel-13 CRs Maintenance (AI 7.1), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1), Study on Latency reduction techniques (AI 7.3.10), Enhancements on Full-Dimension (FD) MIMO for LTE (AI 7.3.3) and Downlink Multiuser Superposition Transmission for LTE (AI 7.3.4).
- Thursday (LTE session2): chaired by Wanshi Chen
  - Rel-13 eMTC CRs (AI 7.1.5), Downlink Multiuser Superposition Transmission for LTE (AI 7.3.4), Study on LTE-based V2X Services (AI 7.3.9), Enhanced Licensed-Assisted Access Using LTE (AI 7.3.1) and Support for V2V services based on LTE sidelink (AI 7.3.2).
- Thursday (LTE session3):
  - Study on channel model for frequency spectrum above 6 GHz (AI 8.2) chaired by Tuomo Säynäjäkangas from Nokia and session on NB-IoT (AI 7.2.1) chaired by Brian Classon from Huawei.

- Friday: Revisions. Continued offline in the morning (eLAA,…).

The list of action points that required RAN1 close follow-up is listed in Annex F (end of document).

The number of contribution documents for this meeting was xxxx, and those documents were categorized as followed.

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Agenda Item	Input Document	Treated Document
All		

Note: The amount of documents includes those discussed during the email discussion session post meeting.

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

1 Opening of the meeting

Mr Satoshi Nagata (RAN1 Chairman) welcomed the participants of the RAN WG1 85 meeting and opened the meeting at 09:00. Mr Tong Hui from CMCC welcomed the delegates on behalf of the Chinese Friends of 3GPP , CATT, CATR, China Mobile, China Unicom, Coolpad, Huawei, Lenovo, Nokia, Oppo, Qualcomm, Samsung, ZTE and detailed the domestic arrangements for the full week.

1.1 Call for IPR

The attention of the members of this Technical Specification Group was drawn to the fact ***that 3GPP Individual Members have the obligation*** *under the IPR Policies of their respective Organizational Partners to* ***inform their respective*** *Organizational Partners* ***of Essential IPRs they become aware of****.*
The members take note that they are hereby invited:

- *to investigate whether their organization or any other organization owns IPRs which were, or were likely to become Essential in respect of the work of 3GPP.*
- *to notify their respective Organizational Partners of all potential IPRs, e.g., for ETSI, by means of the IPR Information Statement and the Licensing declaration forms (e.g. see the ETSI IPR forms http://webapp.etsi.org/Ipr/).*

1.2 Competition law statement

The Chairman also drew Member's attention to the fact that 3GPP activities are subject to antitrust and competition laws and that compliance with said laws is therefore required of any participant of this WG meeting including the Chairman and Vice Chairmen.
In case of question, please contact your legal counsel.
The present meeting will be conducted with strict impartiality and in the interests of 3GPP.
Furthermore, the Chairman reminded Members that timely submission of work items/contributions in advance of WG meetings is important to allow for full and fair consideration of such matters.

1.3 Network usage conditions

The PCG has laid down the following network usage conditions:

Users shall not use the network to engage in illegal activities. This includes activities such as copyright violation, hacking, espionage or any other activity that may be prohibited by local laws.

Users shall not engage in non-work related activities that consume excessive bandwidth or cause significant degradation of the performance of the network.
Since the **network is a shared resource**, users should exercise some basic etiquette when using the 3GPP network at a meeting. It is understood that high bandwidth applications such as downloading large files or video streaming might be required for business purposes, but delegates should be strongly discouraged in performing these activities for personal use. Downloading a movie or doing something in an interactive environment for personal use essentially wastes bandwidth that others need to make the meeting effective. The meeting chairman should remind end users that the network is a shared resource; the more one user grabs, the less there is for another. Email and its attachments already take up significant bandwidth (certain email programs are not very bandwidth efficient). In case of need the chair can ask the delegates to restrict IT usage to things that are essential for the meeting itself.

1. DON'T place your WiFi device in ad-hoc mode
2. DON'T set up a personal hotspot in the meeting room
3. DO try 802.11a if your WiFi device supports it
4. DON'T manually allocate an IP address
5. DON'T be a bandwidth hog by streaming video, playing online games, or downloading huge files
6. DON'T use packet probing software which clogs the local network (e.g., packet sniffers or port scanners)

2 Approval of Agenda

R1-163960 **Draft Agenda of RAN1#85 meeting** **RAN1 Chair**
Satoshi Nagata (Chairman) proposed the agenda for the meeting, as well the schedule of the week.
Discussion: Vodafone asked clarifying the overlap between NR session and NB-IoT maintenance on Tuesday's afternoon
Chair → it will highly depend on the progress achieved during Monday's afternoon maintenance session.
Decision: The agenda is approved.

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3 Approval of Minutes from previous meeting

R1-165448 Final Report of 3GPP TSG RAN WG1 #84 bis v2.0.0 ETSI (R1-163961)
The document was presented by Patrick Mérias (ETSI Mobile Competence Center) and provides the outcomes of last meeting in Korea.
Discussion: MCC→ report is revised as one agreement of the email thread [84b-06] was overlooked in R1-163961.
Few typos/editorials also corrected.
Decision: The document is approved.

4 Incoming Liaison Statements

Dual connectivity related

R1-163969 LS on RLM for PSCell in dual connectivity RAN2, Intel
The document was presented by Hong He from Intel and informs RAN1 and RAN4 about discussion that took place related to RLM for PSCell in dual connectivity. RAN2 has the understanding that if eNB does not configure the timers/constants for RLM then the consequence is that RLF due to physical layer failure will never be triggered for the PSCell.
Decision: The document is noted.

R1-164121 Discussion on RLM for PSCell in dual connectivity Intel Corporation
The document was presented by Hong He from Intel and deals with the potential spec changes on the UE behavior of RLM on PSCell in dual connectivity (DC) in order to reduce power consumption.
Discussion: Corresponding draft CR in R1-164122.
Decision: The document is noted.

R1-164122 Draft CR on correction on RLM for PSCell in dual connectivity Intel Corporation
Clarify that the downlink radio link quality of the PSCell of the SCG shall be monitored by the UE for the purpose of indicating out-of-sync/in-sync status to higher layers, only if the UE is configured with a SCG and the parameter *rlf-TimersAndConstantsSCG* provided by the higher layers is not set to release.
Discussion: Qualcomm→ case where UE is not configured should be considered.
Decision: The document is noted. Continue offline discussion.
Friday
R1-165724 Correction on RLM for PSCell in dual connectivity Intel Corporation, Panasonic Rel-13 36.213 13.1.1 LTE_SC_enh_dualC-Core, TEI13 CR0684 F
Decision: The document is agreed.

LAA related

R1-163973 LS to RAN on new RAN4 TR for documenting multi-node tests for LAA RAN4, Ericsson
The document states that a new RAN4 TR can be defined to document the multi-node tests for Rel-13 LAA operation. The same TR can be used to introduce new multi-node tests in future releases also, if needed.
Discussion: No comment.
Decision: The document is noted.

R1-164114 LS regarding 3GPP LTE based technologies operating in the unlicensed bands City of New York (Counsel to the Mayor of)
The document was presented by RAN1 Chair on behalf of NYC. The letter lists a number of WiFi-based applications and use cases the City of New York has committed to deliver to their residents and raises concerns on the potential impact of 3GPP standardizedf LTE-Unlicensed regarding lower level WiFi signals.
The letter also refers to the review of the incoming LS from WiFi Alliance (R1-163388) and IEEE 802 (R1-163375).
Discussion: Qualcomm suggested focusing on the replies to WFA and IEEE and, when ready copy NYC.
Decision: The document is noted.

R1-164393 Draft response LS to 802dot11 regarding LAA Qualcomm Incorporated
The document was presented by Peter Gaal from Qualcomm. Reply to R1-163375.
Discussion: Broadcom → let's review the content of the reply LS offline.
Decision: The document is noted. Continue offline discussion.
Friday
R1-165998 Draft Response LS to IEEE 802.11 regarding LAA Qualcomm
Decision: The document is noted and final LS is agreed in R1-166040.

R1-164394 Draft response LS to WFA regarding LAA Qualcomm Incorporated
The document was presented by Peter Gaal from Qualcomm. Reply to R1-163388.
Discussion: Broadcom → let's review the content of the reply LS offline.
Decision: The document is noted. Continue offline discussion.

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Friday

R1-165999 Draft response LS to WFA regarding LAA Qualcomm Incorporated
Decision: The document is noted and final LS is agreed in R1-166041

R1-165449 Review of 3GPP LAA Specification Rel. 13 IEEE 802 LAN/MAN SC
The document was presented by RAN1 Chair on behalf of IEEE. IEEE 802 would appreciate an acknowledgment from 3GPP RAN that the LAA Rel. 13 specification will not be complete until all outstanding issues raised by all stakeholders, including 3GPP RAN1, IEEE 802 and the Wi-Fi Alliance, have been resolved.
Discussion: Qualcomm → RAN's reply is more appropriate.
Decision: The document is noted. RAN1 understanding is that RAN should reply to IEEE.

eMTC related

R1-163974 LS on continuous uplink transmission in eMTC RAN4, Intel
The document was presented by Debdeep Chatterjee from Intel and asks RAN1 to clarify the expected eMTC UE behaviour:
- Is RAN1 considering the introduction of any mechanism for maintaining frequency and timing accuracy in eMTC, for example similar to the mechanism used in NB-IoT?

Decision: The document is noted.

R1-165224 Discussion on continuous uplink transmissions in eMTC Intel Corporation
The document was presented by Debdeep Chatterjee from Intel.
- Observation 1: Maintaining 0.1ppm of frequency accuracy during prolonged UL transmission bursts spanning multiple seconds can be extremely challenging and expensive, if not impossible, for HD-FDD eMTC UEs.
- Observation 2: Introduction of UL compensation gaps is not expected to impact eMTC UEs in CE mode A or those UEs that only support CE mode A.
- Proposal 1: UL compensation gaps are introduced for eMTC UEs long uplink (i.e. PUSCH/PRACH) transmissions.
  - During the UL gaps, the UE may switch to the DL and performs time/frequency synchronization
  - The UL gap is defined by a gap period (X ms) and gap length (Y ms)
  - The values of X and Y are to be determined by RAN4 and are fixed in the specifications.
- Proposal 2: Send an LS response to RAN4 indicating RAN1 support for the introduction of UL gaps for HD-FDD eMTC UEs with long UL transmissions (of PUSCH and PRACH) and asking them to determine the values of the maximum duration of continuous UL transmission and the UL gap length for eMTC UEs.

Decision: The document is noted.

R1-165225 Draft reply LS on continuous uplink transmissions in eMTC Intel Corporation
Discussion: ZTE's proposal in R1-165133.
Intel→ let's get feedback from RAN4.
Qualcomm, Huawei requested more time for review during the week.
Decision: The document is noted.

R1-165133 Discussion on UL gap for eMTC ZTE
Proposal 1: Mechanism of uplink compensation gaps in NB-IoT can be reused for Rel-13 eMTC.
- *For any PUSCH transmission with duration greater than X ms, a final UL gap of duration Y ms is inserted at the end of the PUSCH transmission.*
- *It is preferable that the value of X and Y equals to the multiples of maximum of Y_{ch}.*

Decision: The document is noted.
Continue offline discussion under AI 6.1.5– (Intel)

NB-IoT related

R1-163963 LS on NB-IoT RRM requirements RAN2, Huawei
The document was presented by Matthew Webb from Huawei.
- RAN2 assumes that RSRQ is only used for cell selection. RAN2 would like to RAN4 to further provide the value range of q-Qual for NB-IoT.
- RAN2 agrees RSRP is used for both cell selection and cell reselection and would like to ask RAN4 to provide range of q-RxLev.
- RAN2 assumes that Pcompensation is used in the cell selection criteria S: Srxlev = Qrxlevmeas – Qrxlevmin – Pcompensation – Qoffsettemp and would like to ask RAN4 whether this in line with RAN4's understanding and if so to provide parameters and the associated value ranges to calculate the Pcompensation.
- RAN2 assumes that NB-IoT supports additionalSpectrumEmission and additionalPmax per band (8 bands), and this is mandatory for the UE. RAN2 would like to ask RAN4 whether this assumption is correct and to provide value ranges for relevant parameters.
- RAN2 would also like to ask RAN4 to provide feedback on whether a NB-IoT carrier is identified by <EARFCN, offset>

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Discussion: No action to RAN1.
Decision: The document is noted.

R1-163964 Reply LS on per-UE configuration to allow exception reporting RAN2, Qualcomm
The document was presented by Peter Gaal from Qualcomm and states that at least one use case for per-UE configuration to allow exception reporting is to prevent abuse of the RRC establishment cause mo-ExceptionData because exception data is handled with priority in the network. RAN2 requests CT1 and SA2 to consider how to prevent applications in the UE from abusing the RRC access cause in the upper layers.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-163965 Reply LS on direct SI update indication for NB-IoT RAN2, Ericsson
The document was presented by Asbjorn Grovlen from Ericsson and confirms that

- The system information change indication (1bit for Systeminfomodification and 1bit for systemInfoModification-eDRX) carried in DCI is supported.
- RAN2 will capture this direct indication bit field for NB-IoT in TS 36.331.

Discussion: Already captured in RAN1 spec.
Decision: The document is noted.

R1-164120 LS on direct indication DCI bits for NB-IoT RAN2, Huawei
The document was presented by Matthew Webb from Huawei and RAN2 agreed to assume that 6 "spare" bits are included in DCI for future use, as shown in the following table:

Table : Direct Indication information

Bit	Field
1	*systemInfoModification*
2	*systemInfoModification-eDRX*
3, 4, 5, 6, 7, 8	Not used, and shall be ignored by category NB UE if received.

Discussion: Already captured in RAN1 spec.
Decision: The document is noted.

R1-163966 Response to LS on questions on CIoT RAN2, Vodafone
The document was presented by RAN1 chair on behalf of Vodafone.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-163967 Reply LS on NB-IoT RAN2, Huawei
The document was presented by Matthew Webb from Huawei and confirms that:

- 2 bits in NB-MIB will be used to indicate the two LSB of HyperSFN,
- Regarding paging and system information, RAN2 is under discussion and would like to inform RAN1 later the decision,
- The NB-SIB1 modification period is 40.96s.

Discussion: Already captured in RAN1 spec.
Decision: The document is noted.

R1-163971 Response LS on Reply LS on questions on NB-IOT RAN3, Nokia
The document was presented by Michel Robert from Nokia and states that RAN3 has agreed the new *NAS PDU Transmission Delay Indicator* IE in the S1AP Initial UE Message message of the attached CR against TS36.413 which is one of the draft RAN3 CRs for cIOT optimization. This IE represents an expected delay for the transmission of the NAS PDU as a factor relative to the delay assumed at the MME without this indication. RAN3 is still considering whether this IE could additionally be introduced for the UP cIOT optimization.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-164119 Reply LS on questions on NB-IOT RAN2, Nokia
The document states that RAN2 agreed not to adjust NAS timers based on the coverage level in NB-IoT. RAN2 agreed that NAS timers should be long enough i.e. taking into account the worst transmission delay in NB-IoT. RAN2 may provide further feedback about transmission delay of the NAS PDU in non-NB-IoT later.
Discussion: No action to RAN1.
Decision: The document is noted.

R1-165417 LS on TB sizes for SI-messages for NB-IoT RAN2, Ericsson

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The document was presented by Asbjorn Grovlen from Ericsson and asks RAN1 to feedback early at RAN1#85 meeting whether adding two new TB sizes of 56 bits and 120 bits for SI messages is possible, and if so, to inform RAN2 which values of ITBS/ISF from TS 36.213 should be used.
Discussion: Contributions available on the topic, for review during the week.
Decision: The document is noted.

UTRA related

R1-163962 Reply LS on Cell FACH DTx/DRx Enhancements signalling RAN2, Qualcomm
The document was presented by Vasanthan Raghavan from Qualcomm and provides the following feedback:
- RAN2 specification does not allow configuring the UE to only listen to one HS-SCCH every FACH DRX cycle.
- RAN2 specification allows configuring the UE to listen to two HS-SCCH sub-frames every FACH DRX cycle in the 2-level FACH DRX mechanism.

Decision: The document is noted.

Mobility enhancement related

R1-163968 LS on the feasibility of mobility enhancement solutions RAN2, ZTE
The document was presented by Zhisong Zuo from ZTE and raises:
- Q1: Would the accuracy of the TA value calculated according to the schemes in the attachment be sufficient for transmitting PUSCH/PUCCH/SRS at the target cell in either synchronous or asynchronous network? (RAN1/RAN4)
- Q2: Assuming the TA value can be calculated accurately, would starting PUCCH/PUSCH/SRS transmission directly (i.e. without power ramping step) be feasible? (RAN1/RAN4)
- Q5: Is it feasible that the UE performs simultaneous transmission to two intra-frequency cells in either synchronous or asynchronous network in the following two cases? (RAN1/RAN4)
  - Case 1: PUSCH/PUCCH/SRS to one intra-frequency cell and PUSCH/PUCCH/SRS/PRACH preamble to another intra-frequency cell
  - Case 2: PUSCH/PUCCH/SRS to one intra-frequency cell and PRACH preamble in the other intra-frequency cell

Decision: The document is noted.

R1-164644 Draft reply LS on the feasibility of mobility enhancement solutions ZTE
The document was presented by Zhisong Zuo from ZTE.
Decision: The document is noted.

R1-165226 Discussion on feasibility of mobility enhancement solutions Intel Corporation
The document was presented by Seunghee Han from Intel.
Discussion: Intel → RAN1 should discuss further based on the discussion in Section 3.
Decision: The document is noted.
R1-165227 DRAFT Reply LS on the feasibility of mobility enhancement solutions Intel Corporation
Decision: The document is withdrawn.

R1-165370 Discussion on the mobility enhancements solutionsNokia, Alcatel-Lucent Shanghai Bell
The document was presented by Jari Lindholm from Nokia and provides views to the questions in R1-163968. Some changes to the physical layer specifications may need to be done. Changes related to RACH-less handover are more straightforward (e.g. modification to SSTD measurement) but further studies are needed for make-before-break type of operation. It should be noted that currently RAN2, RAN3 and RAN4 have TU allocation for this work item but RAN1 does not have, so RAN1 cannot do detailed studies on these issues.
Discussion: Ericsson, Huawei → no TU allocated, further studies needed → that's should be the answer.
Decision: The document is noted. RAN1 will liaise to RAN2 and tell RAN2 that further study is needed in RAN1. Prepare a draft reply LS to RAN2 – (ZTE)
Friday
R1-165986 [Draft]Reply LS on the feasibility of mobility enhancement solutions ZTE
Decision: The document is noted and final LS is agreed in R1-165996.

eLAA related

R1-163970 LS on RAN2 agreements on eLAA RAN2, Huawei
The document was presented by Xiayuan from Huawei.
Decision: The document is noted. For information to RAN1.

V2X related

R1-163975 LS on EPC procedures for providing eNB with V2X authorization information SA2, LGE

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The document was presented by Hanbyul Seo from LGE and discusses EPC procedures for providing the eNB with V2X authorization information. Following two questions were raised:

- Whether it is required to have an indication to differentiate between a UE and an RSU implemented as a UE (i.e. UE-type RSU) from the PC5 radio resource allocation perspective?
- Whether it is required to have separate indications for different UE types/roles (i.e. Vehicle UE and Pedestrian UE) from the PC5 radio resource allocation perspective?

Discussion: No action to RAN1.
NEC has prepared a reply LS in R1-165452.
Decision: The document is noted.

R1-165414 Reply LS on EPC procedures for providing eNB with V2X authorization information SA1, LGE
The document was presented by Hanbyul Seo from LGE and feedbacks SA1'view whether it is acceptable to distinguish between the UE-type RSU, Vehicle UEs (UE in vehicle or installed in a vehicle) and Pedestrian UEs.

- From service requirements' perspective, there is no need to differentiate UEs.

Discussion: No action to RAN1.
Decision: The document is noted.

R1-165415 Reply LS on V2X message characteristics SA3, TNO
The document was presented by RAN1 chair on behalf of TNO and informs RAN2 that SA3 is studying the security of V2X and will provide the requested size of a possible security overhead in due course.
Discussion: No action to RAN1.
Decision: The document is noted.

NR related

R1-163972 LS on Parameters for WP5D Sharing and compatibility studies RAN4, Ericsson
The document was presented by Stefan Parkvall from Ericsson and asks RAN1 to take note of the intentions of RAN4 to prepare a response to parameters 3 to 7.4 in R1-163390 and to any additional RF parameter of relevance. RAN4 also asks RAN1 to keep RAN4 informed about any progress on NR access scheme parameters, in particular for aspects that are believed to have any direct or indirect impact on RF characteristics such as unwanted emission levels, sensitivity, etc. This includes, but may not be limited to, the following parameters:

- Access technique (No. 1 in the LS)
- Modulation parameters (No. 2 in the LS)
- Channel spacing (No. 3 in the LS)
- Channel bandwidth (No. 4 in the LS)
- Signal bandwidth (No. 5 in the LS)
- Beam forming parameters
- Power dynamic range (No. 6.1 in the LS)
- SINR performance

RAN4 will keep RAN1 updated in its progress on the relevant sharing parameters and plans to send a more detailed LS to RAN1 at the May WG meetings. A first response from RAN1 would be very helpful during the May meetings, followed by a second response in August.
Decision: The document is noted. To be handled under AI 7.1.

R1-164260 Formation of IEEE 1914 Next Generation Fronthaul Interface Working Group IEEE 1914 Next Generation Fronthaul Interface (NGFI) Working Group
The document was presented by RAN1 Chair and informs about the creation of IEEE 1914 Next Generation Fronthaul Interface (NGFI) Working Group to develop IEEE 1914.1 Standard for Packet-based Fronthaul Transport Networks. The scope of this project includes:

- Transport network architecture for the transport of mobile fronthaul traffic (e.g., Ethernet-based), including user data, management and control plane traffic.
- Requirements and definitions for the fronthaul networks, including data rates, timing and synchronization, quality of service etc.

Decision: The document is noted. RAN3 in charge of replying.

R1-164286 LS on Remaining Issues on Path Loss Scenarios New York University Wireless
The document was presented by RAN1 Chair and provides NYU WIRELESS observations regarding the recent RAN1 84Bis channel modeling activity.
Discussion: Further discussion can be handled during the channel model session.
Decision: The document is noted.

The following LS have been received in the course of the week:
R1-165655 LS to RAN1 on RAN2 agreements related to V2X RAN2, LGE

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R1-165722 Reply LS on questions on NB-IOT CT1, Nokia
R1-165723 LS to RAN1 on SPS RAN2, LGE
R1-165727 LS on V2V transmission path selection RAN2, Huawei
R1-165753 Reply LS on NB-IoT RRM requirements RAN4, Huawei
Decision: The document is noted. See AI 6.1.6
R1-165754 LS on RRM measurement for NB-IOT RAN4, Ericsson
Decision: The document is noted. See AI 6.1.6
R1-165817 Response LS on PUSCH transmission for eLAA RAN4, Nokia
Decision: The document is noted. See AI 6.2.2.1
R1-165838 LS to RAN1 on RAN2 agreement on eLAA RAN4, Nokia
Decision: The document is noted. See AI 6.2.2.5
R1-165894 Response to LS on uplink transmission gap in NB-IoT RAN4, Sony
Decision: The document is noted. See AI 6.1.6
R1-165895 LS on Tx Gaps for Frequency Error Correction RAN4, Qualcomm
Decision: The document is noted. See AI 6.1.6
R1-166004 Response LS on realistic power amplifier model for NR waveform evaluation RAN4, Nokia
Decision: The document is noted. See AI 7.1.2

5 UTRA

R1-165865 Chairpersons' summary of the UMTS sessions UMTS Session Chairpersons (Huawei, Ericsson)
The document was presented by Carmela Cozzo from Huawei and Florent Munier from Ericsson.
Decision: The document is endorsed and content is incorporated as below.

5.1 Maintenance of UTRA Releases 4 – 13

5.1.1 FDD

R1-164364 Clarifications to DCH enhancements feature Qualcomm Europe Inc.(France)
Decision: The document is noted.

Proposal 1: Disallow multiple "maximum TTI" channels each with a transport format with zero transport blocks.
Proposal 2: Transmit UL TPC on DL when there is UL SRB transmission in the case of single transport channel configurations with 40 ms TTI.
Conclusion: Proposal 2 is agreed. Whether it impacts the specifications is FFS.
Proposal 3: Specify DL synchronization behavior in the context of DCH enhancements.
Proposal 4: When TFCI 0 is indicated UL DPCCH is transmitted on both frames.
Proposal 5: NodeB should transmit TPC command on the first slot after gap.
Proposal 6: Disallow the concurrency of PCA2 and DCH enhancements.
Proposal 7: NodeB shall transmit in 20 ms mode when it doesn't detect UL reliably.
Conclusion: Proposal 7 is agreed. Whether it impacts the specifications is FFS.
Proposal 8: Disallow DCH enhancements with PS mapped to HS or EUL in the absence of CPC for 20 ms only mode.
Email discussion on proposals 2/4/7/8 from R1-164364 until June 8, 2016 – (Qualcomm)

R1-164365 Clarifications on DCH enhancements feature Qualcomm Europe Inc.(France)
Decision: The document is noted. Further revised in R1-165862.
R1-165862 Rel-12 25.214 CR0747 F
Decision: The document is agreed.
R1-164366 Clarifications on DCH enhancements feature (Mirror Rel-13) Qualcomm Europe Inc.(France)
Decision: The document is noted. Further revised in R1-165863.
R1-165863 Rel-13 25.214 CR0748 A
Decision: The document is agreed.
R1-164367 Clarifications on DCH enhancements featureQualcomm Europe Inc.(France)
Decision: The document is noted. Further revised in R1-165515.
R1-165515 Rel-12 25.212 CR0339 F
Decision: The document is agreed.
R1-164368 Clarifications on DCH enhancements feature (Mirror Rel-13) Qualcomm Europe Inc.(France)
Decision: The document is noted. Further revised in R1-165516.
R1-165516 Rel-13 25.212 CR0340 A
Decision: The document is agreed.

R1-165336 Clarification on UL DPCH 10ms Mode Ericsson
Decision: The document is noted. (25.212 12.1.0 UTRA_DCHenh-Core CR0337 F)
For email approval until June 8, 2016 - (Ericsson)

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R1-165337 Clarification on UL DPCH 10ms Mode Ericsson
Decision: The document is noted. (25.212 13.0.0 UTRA_DCHenh-Core 0338 A)

Not pursued.
R1-165338 Clarification on measuring the transmitted code power for the downlink DPCH slot formats #17 and #18 Ericsson Rel-12 25.215 12.1.0 UTRA_DCHenh-Core 0207 F
R1-165339 Clarification on measuring the transmitted code power for the downlink DPCH slot formats #17 and #18 Ericsson25.215 13.0.0 UTRA_DCHenh-Core 0208 A

5.1.2 TDD

None

5.2 Multi-Carrier enhancements for UMTS - WID in RP-152290.

5.2.1 Performance evaluation

R1-165084 **Further evaluation results for [2+10]ms TTI in DB-DC-HSUPA Huawei, HiSilicon**
Decision: The document is noted.
R1-165085 **Further evaluation results for [10+10]ms TTI in DB-DC-HSUPA and DC-HSUPA Huawei, HiSilicon**
Decision: The document is noted.
R1-165325 **Further Evaluation of Multicarrier Enhancements for DC HSUPA Ericsson**
Decision: The document is noted.
R1-165326 Further Evaluation of Multicarrier Enhancements for DB-DC HSUPA Ericsson
Decision: The document is noted.
TP of evaluation in R1-165084/5 revised in R1-165509
R1-165509 **TP on Evaluation results Huawei, HiSilicon**
Decision: The document is noted and TP is agreed.

5.2.2 Other

R1-165086 **Impact on legacy terminals Huawei, HiSilicon**
Decision: The document is noted.
R1-165087 **TP on impact on legacy terminals Huawei, HiSilicon**
Decision: The document is noted.
R1-165088 **Impact on specifications Huawei, HiSilicon**
Decision: The document is noted.
R1-165089 **TP on impact on specifications Huawei, HiSilicon**
Decision: The document is noted.
R1-165090 **Conclusion on MultiCarrier enhancements Huawei, HiSilicon**
Decision: The document is noted.
R1-165327 **Impact of Multicarrier Enhancements on L1 Mechanisms and standards Ericsson**
Decision: The document is noted.
R1-165328 **View on the conclusions for the SI on Multicarrier Enhancements for UMTS Ericsson**
Decision: The document is noted.
R1-165329 **Text proposal: Evaluation of Multicarrier Enhancements Ericsson**
Decision: The document is noted. Revised in R1-165508
R1-165508 **Text proposal: Evaluation of Multicarrier Enhancements Ericsson**
Decision: The document is noted and TP is agreed
R1-165513 **Text proposal: Evaluation of Multicarrier Enhancements Qualcomm**
Decision: The document is noted and TP is agreed
R1-165330 **Text proposal: Impact of Multicarrier Enhancements on L1 Mechanisms and standards Ericsson**
Decision: The document is noted.
R1-165331 **Text proposal: View on the conclusions for the SI on Multicarrier Enhancements for UMTS Ericsson**
Decision: The document is noted.
R1-165088 and R1-165330 captured in R1-165507
R1-165507 **Text proposal on impact on specifications and UE implementation Ericsson**
Decision: The document is noted and TP is agreed
R1-165510 **TP on conclusions for the Multicarrier Enhancements for UMTS Huawei**
Decision: The document is noted and TP is agreed

Agreements
In summary, among the new proposed dual carrier solutions (including the DB-DC-HSUPA) 2ms+10ms or 10ms+10ms overall provide benefits depending on how much path loss is present and how much power is allocated to the primary carrier, and may

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outperform 2ms+2ms DC- and DB-DC HSUPA. However the performance of single carrier is larger than the proposed dual carrier configurations when grant limitation does not occur.

- **Simulations and scenarios:** Scenarios discussions spanned multiple DC-HSUPA and DB-DC-HSUPA scenarios, and also single carrier HSUPA. The scenarios vary in terms of TTI lengths in each subcarrier, power setting per subcarrier and maximum transmitted UE power. Control channel overhead was not taken into consideration in the evaluation (see Section x.x.x). Several companies presented link simulations
- **In good coverage** i.e. when the UE is near the base station, legacy dual carrier 2ms+2ms TTI outperforms both for DB-DC-HSUPA and DC-HSUPA. It is also observed that 10ms+10ms in DC-HSUPA and 2ms+10ms in DB-DC-HSUPA outperform single carrier HSUPA.
- **In medium coverage** dual carrier configurations (i.e., 2ms+2ms and 10ms+10ms DC-HSUPA, as well as 2ms+2ms, 2ms+10ms and 10ms+10ms DB DC-HSUPA) are outperformed by single carrier 2 or 10 ms TTI only when it is possible to allocate the power of the single carrier with a value exceeding the power allocated to the primary uplink frequency of the DC or DB-DC cases. Among the new proposed dual carrier solutions (including the DB-DC-HSUPA) 2ms+10ms or 10ms+10ms overall provide similar benefits depending on how much path loss is present and how much power is allocated to the primary carrier, and outperforms 2ms+2ms DC- and DB-DC HSUPA. The UE-NodeB distance where the legacy 2ms DC-HSUPA (DB-DC-HSUPA) is outperformed by either the single carrier or the proposed dual carrier (i.e. DC or DB-DC HSUPA) configurations depends on the power configuration.
- **In poor coverage** (e.g. near the cell boundary)**,** single carrier configuration with 10ms TTI dominates the overall performance.

R1-165511 LS on RAN1 multi-carrier enhancements for UMTS agreements RAN1
Decision: The document is agreed.

Updated TR in R1-165514.
Email discussion on updated TR25.707 until Monday June 6, 2016 (Huawei)

5.3 DTX/DRX enhancements in CELL_FACH - WID in RP-160185.

5.3.1 DRX improvements

R1-164362 HS-SCCH DRX lite design with enhanced servicing ability Qualcomm Europe Inc.(France)
Decision: The document is noted.
R1-164363 Open Issues on HS-SCCH DRx lite proposal Qualcomm Europe Inc.(France)
Decision: The document is noted.
R1-165332 A view on DRX enhancements in CELL_FACH Ericsson
Decision: The document is noted.

QC proposal for HS-SCCH DRX Lite Design was noted. The following considerations for DRX Improvements are listed:

- Enable the network to schedule the UE in more than one subframe (Rx Burst of e.g. 0.4, 0.8 frames)
- Investigate the possibility of using HS-SCCH control information rather than HS-SCCH orders
- For example Mechanism and reliability
- Enable 640 ms mode in HS-SCCH /HS-DSCH DRX in CELL FACH mode in addition to existing values present in IE *HS-DSCH DRX cycle$_{FACH}$*

R1-165512 LS on HS-SCCH DRx Design in Cell FachRAN1, Qualcomm
Decision: The document is agreed.

Conclusion
Based on the analysis performed, the following observations have been made:

- Observation 1: The proposals made on the "DRX enhancements area" may certainly bring benefits in terms of battery savings based on creating more opportunities for the UE to stay in a sleep period.
- Observation 2: The analysis made in this contribution aims at keeping the impact on the specifications as low as possible, encouraging at the same time the use of the solutions that are already available in the standard.

- Proposal 1: Take observations 1 and 2 on "DRX enhancements" into account, and discuss the technical details within the TSG RAN WG2 since most of it design (i.e., a part from the assessment on the potential gains and the design of the HS-SCCH orders) is connected to the RAN2 specifications.

5.3.2 DTX improvements

R1-165091 Evaluation results for DTX in CELL_FACH Huawei, HiSilicon
Decision: The document is noted.
R1-165092 Further considerations on the design of DTX in CELL_FACH Huawei, HiSilicon
Decision: The document is noted.

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Huawei will come back with revised results with an updated model according to the following:

- Back off timer starts as soon as the buffer of the UE is empty (TEBS)
- Account for blocking rate and noise rise (cell capacity issues).

R1-165333 **An assessment on the potential gains associated to the introduction of DTX in CELL_FACH Ericsson**
Decision: The document is noted.
R1-165334 **On applying DTX on the UL DPCCH prior to an E-DCH retransmission in CELL_FACH Ericsson**
Decision: The document is noted.
R1-165335 **Summary of the potential gains and technical implications of introducing DTX in CELL_FACH Ericsson**
Decision: The document is noted.

Agreement: It may be possible to configure, the "Back-off" timer and the number of "Common E-DCH resources" available in the cell as a function of the CELL_FACH traffic, in order to achieve a trade-off between:

- amount of uplink interference,
- E-DCH resource blocking rate,
- Cell capacity

6 E-UTRA

6.1 Maintenance of E-UTRA Releases 8 – 13

6.1.1 Maintenance of E-UTRA Release 8 – 12

None.

6.1.2 Maintenance of Release 13 LTE carrier aggregation enhancement beyond 5 carriers

R1-164196 **Draft 36.213 CR Clarification on PUCCH format 4/5 resource derivation CATT**
The document (draft CR to 36.213) was presented by Fang Chen Cheng from CATT.
Discussion: Huawei → UE behavior is not correctly captured. Doesn't work.
Decision: The document is noted.

- UE behaviour of TPC mapping is different for PUCCH formats 3, 4, and 5 in Rel-13 compared to that of PUCCH format 3 in Rel-12
  - No spec change is needed

R1-164733 **HARQ-ACK Codebook on PUSCH for TDD Samsung**
The document was presented by Aris Papasakellariou from Samsung.

- Proposal: For TDD and a UE configured with more than 5 cells, the HARQ-ACK codebook in the PUSCH is determined as for FDD.

Discussion: Late change according to Huawei – would like to understand spec impact, may need more time.
Decision: The document is noted. Continue offline discussion – (Samsung)
Friday: Email discussion until June 30th – (Samsung)

R1-164926 **Correction on citations to a DAI bits table ITRI**
The document from ITRI clarifies that the DAI bits should be expressed in Table 5.3.3.1.2-2 but not in Table 5.3.3.1.1-2 which is not existed in the specification.
Decision: The document is noted and CR0205 to 36.212 is agreed.

6.1.3 Maintenance of Release 13 licensed-assisted access to unlicensed spectrum

R1-164395 **Draft CR on CWp adjustment Qualcomm Incorporated**
The document (draft CR to 36.213) was presented by Srinivas Yerramalli from Qualcomm and clarifies that when the contention window size is increased, it is done so for every access priority class.
Discussion: Indication of rev in CR coversheet not needed.
Nokia, Huawei believe the change is not needed.
Decision: The document is noted.
LGE: following document addresses the same topic:
R1-164491 **Correction on CWS update for multiple channel access priority classes LG Electronics**
The document specifies the eNB behavior to adjust CWS for all channel access priority classes at the same time.
Decision: The document is noted. Continue offline discussion (Qualcomm)
Friday:

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R1-166039 CR on CWp adjustment Qualcomm Incorporated
Decision: The document is noted and CR0687 to 36.213 is agreed.

R1-164396 DCI Format 1C signaling and expected UE behavior Qualcomm Incorporated
The document was presented by Srinivas Yerramalli from Qualcomm and suggests adding the following statement to section 13A of 36.213.
The UE is not expected to monitor PDCCH with CRC scrambled by CC-RNTI outside of the Active Time defined in [8] in order to determine the configuration of occupied OFDM symbols in any subframe within the Active Time.
Discussion: Panasonic → second part of the sentence may be removed.
Decision: The document is noted.
R1-164397 Draft CR on DCI Format 1C signaling and expected UE behavior Qualcomm Incorporated
Discussion: Indication of rev in CR coversheet not needed.
Decision: The document is noted. Continue offline discussion (Qualcomm)
Friday:
R1-165766 [DRAFT] LS on DRX and Reception of PDCCH scrambled by CC-RNTI Panasonic
Decision: The document is noted and final LS is agreed in R1-166038.

R1-164405 Draft CR on clarification for channel sensing Qualcomm Incorporated
The document was presented by Srinivas Yerramalli from Qualcomm and clarifies that the time quanta of re-attempting sensing the medium is a slot of duration 9 µs instead of Td.
Discussion: Indication of rev in CR coversheet not needed.
Decision: The document is noted. Continue offline discussion (Qualcomm)
Friday:
R1-166022 CR on clarification for channel sensing Qualcomm Incorporated
Decision: The document is noted and CR0686 to 36.213 is agreed.

R1-164490 Discussion on CWS update for multiple channel access priority classes LG Electronics
The document was presented by … from LGE.
Suggestion: Option 1 is supported for Rel-13 LAA.
- Option 1: eNB can change the channel access priority every DL transmission burst.
- Option 2: eNB can change the channel access priority class only when the adjusted CWS is the minimum value.
- Note that additional specification work is not necessary to support Option 1.

Discussion: Seems that all are fine with option 1 – no need to capture anything.
Decision: The document is noted.

R1-164492 Clarification on DL ending partial subframe LG Electronics
The document was presented by … from LGE and proposes a TP for section 13A of 36.213 to clarify the UE behaviour for the reception of DL ending partial subframe and discusses the duration of PDCCH in DL ending partial subframe.
Discussion: Panasonic → doesn't see the need for Rel-13, may be addressed in Rel-14.
Decision: The document is noted.

R1-165324 Draft CR on LAA DL Multichannel access BROADCOM LIMITED
The document (draft CR to 36.213) was presented by Sindhu Verma from Broadcom and suggests extending to all the channels in the same sub-band across multiple groups the restriction of 4 slots pause before resuming countdown of the backoff counter on a CAT4 LBT channel.
Decision: The document is noted. Continue offline discussion – (Broadcom)

6.1.4 Maintenance of Release 13 elevation beamforming/full-dimension MIMO for LTE

R1-164123 Evaluation of MU-MIMO performance with Rel-13 DM-RS Intel Corporation
The document was presented by Yuan Zhu from Intel and provides views on the two alternatives for the DM-RS sets of possibly multiplexed DM-RS antenna ports.
Decision: The document is noted.

R1-165105 Clarification of OCC=2 and OCC=4 MU-MIMO Transmission Ericsson
The document was presented by Mark Harrison from Ericsson.
- Clarify the specification of OCC=2 codepoints to either support OCC=2 only coscheduling or mixed OCC=2 and OCC=4 coscheduling.
  - Support mixed OCC=2 and OCC=4 transmission on ports 7, 8, 11, and 13 unless there is consensus among UE vendors that performance is a significant concern given UE implementation, considering that the Rel-12 table is also available.

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- Specify UE behaviour as proposed in the first correction shown in section **Error! Reference source not found.**, and in the corresponding CR [R1-165105].
  - Otherwise, specify UE behavior to support OCC=2 only coscheduling on ports 7 and 8, as proposed in [R1-163688].

Decision: The document is noted.

R1-165106 MU-MIMO with Mixed Orthogonal Cover Code Length Ericsson
The document (CR0655 to 36.213) was presented by Mark Harrison from Ericsson.

- When a UE is scheduled with OCC=2 and a single layer on port 7, UE assumptions support PDSCH transmission on port 8 and 13 to other UEs.
- When a UE is scheduled with OCC=2 and a single layer on port 8, UE assumptions support PDSCH transmission on port 7 and 11 to other UEs.

Decision: The document is noted.

R1-164317 Correction on UE assumption on DMRS ports ZTE
The document (draft CR to 36.213) clarifies the UE assumption in case of the new DMRS table in DCI formats 2C and 2D is configured for single-antenna port transmission scheme.
Discussion: Aligned with Intel.
Decision: The document is noted and agreed as CR0672 to 36.213 in R1-165538.

R1-164734 Draft CR on FD-MIMO codebooks (36.213) Samsung
Corrections to ensure alignment with the FD-MIMO codebook agreements made in RAN1#82b and RAN1#83.
Decision: The document is noted and agreed as CR0666 to 36.213 in R1-165528.

R1-164735 Draft CR on CSI-Reporting-Type in TS 36.213 Samsung
The document suggests changing the field name 'CSI-reporting-Type' to 'eMIMO-Type'.
Decision: The document is noted and agreed as CR0667 to 36.213 in R1-165529.

R1-164736 Clarification on non-PMI based CSI reporting in TS 36.213 Samsung
Observation: Two options for UE assumption on precoding matrix for PUSCH mode 3-0/PUCCH mode 2-0 are available.

- *Alternative 1: Remove all assumptions on precoding matrix in non-PMI based CSI reporting mode descriptions.*
- *Alternative 2: Release the assumption that 'a single precoding matrix is selected from the CBSR' and clarify that 'for each subband a preferred precoding matrix is selected from the codebook subset assuming transmission only in the subband' in non-PMI based CSI reporting mode descriptions.*

Proposal: Support both options in observation and revise the corresponding descriptions in the current specification.
Discussion: No consensus.
Decision: The document is noted.
R1-164737 Draft CR on non-PMI based CSI reporting in TS 36.213 Samsung
Decision: The document is not treated.

6.1.5 Maintenance of Release 13 further LTE physical layer enhancements for MTC

R1-165932 Chairman's Notes of Agenda Item 6.1.5 on eMTC CRs Ad-hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm and provides the outcomes of eMTC maintenance session.
Decision: The document is endorsed. Contents incorporated below.

Terminology
R1-164833 Correction on the usage of CEModeA and CEModeB for eMTC in TS 36.211 Huawei, HiSilicon
Decision: The document is withdrawn.
R1-165450 Correction on the usage of CEModeA and CEModeB for eMTC in TS 36.213 Huawei, HiSilicon (R1-164834)
Decision: The document is noted and agreed as CR0669 to 36.213 in R1-165531.

PBCH
R1-164402 Remaining issues for eMTC Qualcomm Incorporated
Decision: The document is noted.
R1-165082 Draft CR for clarification of MPDCCH over empty CRS tones in PBCH repetition Qualcomm Incorporated
Decision: The document is noted and agreed as CR0247 to 36.211 in R1-165532.

DCI definition
R1-164835 Correction on the DCI payload size for eMTC in TS 36.212Huawei, HiSilicon

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Decision: The document is noted and agreed as CR0207 to 36.212 in R1-165533.

R1-165386 **Frequency hopping flag definition in DCI formats for BL/CE UE** **Ericsson**
Decision: The document is noted, revised in and agreed as revision 1 of CR0206 to 36.212 in R1-165540

R1-165392 **Definition of number of MPDCCH repetitions for BL/CE UE** **Ericsson**
Decision: The document is noted and CR0662 to 36.213 is agreed.

MPDCCH

R1-164402 **Remaining issues for eMTC** **Qualcomm Incorporated**
Decision: The document is noted.

R1-165671 **Scrambling sequence initialization for PDSCH** **Qualcomm Incorporated, NTT DOCOMO**
Decision: The document is noted and the CR is endorsed. Final CR0252 to 36.211 is agreed in R1-165703.

R1-164401 **Draft CR for scrambling sequence initialization** **Qualcomm Incorporated**
Decision: The document is noted and agreed as CR0248 to 36.211 in R1-165534.

R1-165081 **Draft CR for clarification on starting subframe for MPDCCH** **Qualcomm Incorporated**
Decision: The document is noted and the CR is endorsed. Final CR0681 to 36.213 is agreed in R1-165672.

R1-164602 **eMTC MPDCCH corrections for 36.213** **Sequans Communications**
Decision: The document is noted and revision 1 of CR0653 to 36.213 is agreed in R1-165746.

R1-164843 **On MPDCCH AL and search space for 8 EREGs per ECCE in TS 36.213.** **Huawei, HiSilicon**
Decision: The document is noted and agreed as CR0670 to 36.213 in R1-165536.

R1-164844 **On MPDCCH AL for 8 EREGs per ECCE in TS 36.211.** **Huawei, HiSilicon**
Decision: The document is noted and the CR is endorsed. Final CR0249 to 36.211 is agreed R1-165623

R1-164916 **draft CR on MPDCCH quasi co-location** **Panasonic Corporation**
Decision: The document is noted and agreed as CR0671 to 36.213 in R1-165537.

R1-165382 **Draft LS on MPDCCH configuration for BL/CE UE** **Ericsson**
Decision: The document is noted. Final LS is approved in R1-165748 with the following update:

~~In case #3 above, the two MPDCCH PRB sets can operate as a single MPDCCH PRB consisting of up to 6 PRBs which means that the two sets share so many properties that RAN1 considers that it might be more efficient from RRC signalling point of view to configure them using a single EPDCCH-SetConfig entity with numberPRB-Pairs-v1310 set to 'n6' instead of two separate entities. The second EPDCCH-SetConfig entity specified in TS 36.331 V13.1.0 would then not be used by BL/CE UEs in Rel-13.~~

~~However, f~~For case #3 above, from RAN1 specification point of view it is necessary to know the PRB indices of the 2 PRBs and the 4 PRBs, respectively. RAN1 notes that if the resourceBlockAssignment-r11 can be used to point out the PRB indices of the 2 PRBs then it is trivial to deduce the PRB indicates of the other 4 PRBs in a 6-PRB narrowband for BL/CE UEs. The second EPDCCH-SetConfig entity specified in TS 36.331 V13.1.0 would then not be used by BL/CE UEs in Rel-13.

R1-165385 **Enable cross-subframe channel estimation for BL/CE UE** **Ericsson**
Decision: The document (CR0246 to 36.211) is noted and revised in:

R1-165802 **Enable cross-subframe channel estimation for BL/CE UE** **Ericsson**
Decision: The document is noted and CR0246 is postponed. Revisit in RAN1#86.

R1-165389 **Overlapping MPDCCH search spaces for BL/CE UE** **Ericsson**
Decision: The document (CR0659 to 36.213) is noted and revised in:

R1-165867 **Overlapping MPDCCH search spaces for BL/CE UE Ericsson**
Decision: The document is noted and CR0659 is postponed. Revisit in RAN1#86.

R1-165390 **MPDCCH search space for random access in connected mode for BL/CE UE** **Ericsson**
Decision: The document (CR0660 to 36.213) is noted and revised in:

R1-165868 **MPDCCH search space for random access in connected mode for BL/CE UE** **Ericsson**
Decision: The document (CR0660rev1 to 36.213) is noted and revised in:

R1-165958 **MPDCCH search space for random access in connected mode for BL/CE UE** **Ericsson**
Decision: The document is noted and revision 2 of CR0660 to 36.213 is for email approval until June 3rd – (Ericsson).

R1-165393 **PRB locations for Type0 MPDCCH search space for BL/CE UE** **Ericsson**
Decision: The document is noted and CR0663 to 36.213 is agreed.

PDSCH

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R1-164124 **Draft CR on PDSCH scrambling for eMTC** **Intel Corporation**
Decision: The document is noted.
R1-165312 **Scrambling Sequence for paging MPDCCH and PDSCH** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document (draftCR to 36.211) is noted and revised in:
R1-165578 **Scrambling Sequence for paging MPDCCH and PDSCH** **Nokia, Alcatel-Lucent Shanghai Bell, Intel, Ericsson**
Decision: The document is noted and the CR is endorsed. Final CR0251 to 36.211 is agreed R1-165686.

R1-164927 **Some corrections for eMTC** **ITRI**
Decision: The document is noted and CR0245 to 36.211 is agreed.

R1-165279 **Correction on PDSCH reception timing for eMTC Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted and the CR is endorsed. Final CR0679 to 36.213 is agreed in R1-165636.

R1-165387 **Starting OFDM symbol for SIB1-BR for BL/CE UE** **Ericsson**
Decision: The document is noted and CR0657 to 36.213 is agreed.
R1-165388 **Collision between SIB1-BR and SI message for BL/CE UE Ericsson**
Decision: The document is noted and CR0658 to 36.213 is agreed.

PUSCH
R1-164124 **Draft CR on PDSCH scrambling for eMTC** **Intel Corporation**
Decision: The document is noted.
R1-164488 **Correction of cyclic hopping term for PUSCH DMRS** **NEC**
Decision: The document is noted.
Conclusion: Regarding the issues discussed in R1-164125 and R1-164488, no CR is necessary.

R1-164402 **Remaining issues for eMTC** **Qualcomm Incorporated**
Proposal 1: Capture the agreement that for R=1 the invalid subframes are overridden for the transmission of PUSCH/PUCCH.
Decision: The document is noted.
R1-165080 **Draft CR for overriding of valid-invalid subframes for R=1** **Qualcomm Incorporated**
Decision: The document is noted and the CR is endorsed. Final CR0250 to 36.211 is agreed in R1-165673.

R1-164842 **Correction on RV determination for PUSCH in TS 36.213. Huawei, HiSilicon**
Decision: The document is noted and the CR is endorsed. Final CR0675 to 36.213 is agreed in R1-165624.

R1-165395 **Correction on collision of dynamically scheduled data and semi-statically scheduled data for Rel-13 eMTC Ericsson**
Conclusion: CR in R1-165395 is agreed in principle. As this CR is intended to replace 36.213 CR0637r1 (agreed in R1-163787 – Ran1#84bis), final CR0637r2 to 36.213 is agreed in R1-165568

Continuous UL transmission
R1-163974 **LS on continuous uplink transmission in eMTC** **RAN4, Intel**
Decision: The document is noted.

Not treated.
R1-165413 Continuous Uplink Transmission in eMTC Sony
R1-165133 Discussion on UL gap for eMTC ZTE
R1-165134 Draft reply LS on continuous uplink transmission in eMTC ZTE

R1-165562 **WF on UL gaps for eMTC** **Intel Corporation, Sony, Sequans, Sierra Wireless, ZTE**
Decision: The document is noted. Revised in:
R1-165681 **WF on UL gaps for eMTC** **Intel Corporation, Sony, Sequans, Sierra Wireless, ZTE, Qualcomm, Ericsson**
Decision: The document is noted. Further revised in:
R1-165874 **WF on UL gaps for eMTC** **Intel Corporation, Sony, Sequans, Sierra Wireless, ZTE, Qualcomm, Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, Nordic Semiconductor, Spreadtrum, KT Corporation, Nubia Technology, NEC, InterDigital, CATT**
Decision: The document is noted.

Proposal:
- UL compensation gaps are introduced for HD-FDD eMTC UEs long transmissions PUSCH/PRACH.
  - During the UL gaps, the UE may switch to the DL and performs time/frequency synchronization.

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  - Note that the UE is not required to process DL channels during the UL gaps.
  - The UL gap is defined by a gap period (X ms) and gap length (Y ms).
  - The values of X and Y are to be determined by RAN4 and are fixed in the specifications.
    - Note: From RAN1 perspective, it may be beneficial to align the values of X and Y with the maximum frequency hopping granularity
- 1 bit capability signaling is introduced to enable more capable HD-FDD UEs to indicate that they do not need UL gaps during long UL transmissions to maintain the required frequency accuracy.
  - This bit is included in msg3, and also in the capability report of the UE.
- UL compensation gaps are applicable for PRACH and Msg3 transmissions during initial access regardless of the UE capability
  - For PRACH transmission, gaps do not apply if between two PRACH transmissions there is at least Z ms.
    - RAN4 to decide the value of Z
  - Note that for PDCCH ordered PRACH, the UE applies gaps following the capability signaling.
- During the UL gap durations, the corresponding PUSCH/PRACH transmissions are dropped
- Send an LS response to RAN4 and RAN2 informing them of the above and requesting:
  - RAN4 to determine the values of X, Y, and Z for eMTC UEs considering worst case coverage;
  - RAN2 to provide signaling support for the above capability signalling

Objected by: Huawei, HiSilicon
- Reason from Huawei, HiSilicon: it's a new feature, not essential, and there are other ways to approach this situation. Since it impacts multiple work groups, it should be handled at the RAN plenary.

Continue discussion offline, aim for concluding in RAN1 this week.

R1-165953 WF on UL gaps for eMTC Intel Corporation, Sony, Sequans Communications, Verizon, Sierra Wireless, ZTE, Qualcomm, Ericsson , AT&T, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, NTT DoCoMo, SoftBank Mobile, CATT, Panasonic, NEC, KT Corporation, MediaTek, LG Electronics, Nordic Semiconductor, Spreadtrum, Nubia Technology, InterDigital, Virtuosys, Sharp, WILUS Inc.
Decision: The document is noted.

Proposal:
- UL compensation gaps are introduced for HD-FDD eMTC UEs long transmissions PUSCH/PRACH.
  - During the UL gaps, the UE may switch to the DL and perform time/frequency synchronization.
  - Note that the UE is not required to process DL channels during the UL gaps.
  - The UL gap is defined by a gap period (X ms) and gap length (Y ms).
  - The values of X and Y are to be determined by RAN4 and are fixed in the specifications.
    - Note: From RAN1 perspective, it may be beneficial to align the values of X and Y with the maximum frequency hopping granularity
- 1 bit capability signaling is introduced to enable more capable HD-FDD UEs to indicate that they do not need UL gaps during long UL transmissions to maintain the required frequency accuracy.
  - This bit is included in msg3, and also in the capability report of the UE.
- UL compensation gaps are applicable for PRACH and Msg3 transmissions during initial access regardless of the UE capability.
  - For PRACH transmission, gaps do not apply if between two PRACH transmissions there is at least Z ms.
    - RAN4 to decide the value of Z
  - Note that for PDCCH ordered PRACH, the UE applies gaps following the capability signaling.
- During the UL gap durations, the corresponding PUSCH/PRACH transmissions are dropped.
- Send an LS response to RAN4 and RAN2 informing them of the above and requesting:
  - RAN4 to determine the values of X, Y, and Z for eMTC UEs considering worst case coverage;
  - RAN2 to provide signaling support for the above capability signalling

Objected by: Huawei, HiSilicon
- Reason from Huawei, HiSilicon: it's a new feature, not essential, and there are other ways to approach this situation. Since it impacts multiple work groups, it should be handled at the RAN plenary. In addition, RAN4 wishes to study this, and RAN1 should take no action.

Intel: it is NOT a valid concern that the WF would impact multiple working groups
Further discussion till Friday.

Friday

R1-166015 WF on UL gaps for eMTC Intel Corporation, Sony, Sequans Communications, Verizon, Sierra Wireless, ZTE, Ericsson , AT&T, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, NTT DoCoMo, SoftBank Mobile, CATT, Panasonic, NEC, KT Corporation, MediaTek, LG Electronics, Nordic Semiconductor, Spreadtrum, Nubia Technology, InterDigital, Virtuosys, Sharp, WILUS Inc.
Decision: The document is noted.

R1-166035 **WF on UL gaps for eMTC** **Intel Corporation, Sony, Sequans Communications, Verizon, Sierra Wireless, ZTE, Ericsson, Qualcomm, AT&T, Nokia, Alcatel-Lucent Shanghai Bell, Samsung, NTT DoCoMo, SoftBank Mobile, CATT, Panasonic, NEC, KT Corporation, MediaTek, LG Electronics, Nordic Semiconductor, Spreadtrum, Nubia Technology, InterDigital, Virtuosys, Sharp, WILUS Inc.**
Decision: The document is agreed.

R1-165784 **[DRAFT] Reply LS on continuous uplink transmission in eMTC** **Intel**
Decision: The document is noted and final LS is agreed in R1-166042.

Collision between PUCCH and PUSCH
R1-164597 **Collision between PUCCH and PUSCH** **Sequans Communications**
Decision: The document is noted.
R1-164599 **Correction for collision between PUCCH and PUSCH** **Sequans Communications**
Decision: The document is noted.
R1-165280 **Correction on UCI multiplexing on PUSCH** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
R1-165394 **Multiplexing of UCI and PUSCH for BL/CE UE** **Ericsson**
Decision: The document is noted.
R1-164840 **Correction on collision between PUCCH and PUSCH in TS 36.213** **Huawei, HiSilicon**
Decision: The document is noted.

R1-165708 **Correction on UCI multiplexing on PUSCH** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted and the CR0683 to 36.213 is endorsed, with the following update:
- For a BL/CE UE, and remove BL/CE in the sub-bullets
- Double-check whether FDD/TDD or FS1/FS2 is used, and align the terminology if necessary
- The CR in R1-165625 is withdrawn.

Final CR agreed in R1-165767 (CR0683r1), which is further revised and revision 2 is agreed in **R1-165791**

Decision: The document is noted.

PUCCH
R1-164837 **Correction on the supported PUCCH format for CEModeA in TS 36.213** **Huawei, HiSilicon**
Decision: The document is noted and draft CR is endorsed. Final CR in R1-165625 – wihtdrawn according to the conclusion to R1-165767).

R1-164838 **Clarification on collision between SR and PDSCH with repetitions in TS 36.213** **Huawei, HiSilicon**
Decision: The document is noted. Draft CR is postponed till next meeting. Revisit in RAN1#86.

R1-165383 **PUCCH frequency retuning for BL/CE UE** **Ericsson**
Decision: The document is revised in:
R1-165869 **PUCCH frequency retuning for BL/CE UE** **Ericsson**
Decision: The document is noted.
R1-165903 **WF on PUCCH frequency retuning for BL/CE UE** **Ericsson, Qualcomm, NEC, Sequans, Virtuosys, Softbank, NTT DoCoMo, Sierra Wireless, CATT, Sony, Altair, LG Electronics, InterDigital, Huawei, HiSilicon, Verizon, AT&T, ZTE**
Decision: The document is noted.

Proposal:
- Revoke the following RAN1#84 agreement:
  - Shortening of PUCCH 1/1a/1b in the first slot of a subframe is realized by using in the first slot with PUCCH 1/1a/1b resource mapping from symbols 1 through 6 in the first slot while maintaining the existing PUCCH 1/1a/1b DM-RS locations.
- Agree the following proposal:
  - For PUCCH 1/1a/1b, UL retuning gaps are generated by puncturing of the affected SC-FDMA symbols: last symbol and first symbol of the prior and the latter subframe respectively
    - However, if the prior subframe is an SRS subframe, shortened format of legacy behaviour is applied, i.e., shortened format is applied in the prior subframe, and first symbol of the latter subframe is punctured.

Objected by Samsung:
- Reasons: othogonality is broken for multiplexing different UEs, difficult to acheive the target of 10^-3 performance

Further discussion till Friday.

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Friday
Samsung still maintained their opinion – performances will be broken – suggested having an email discussion and revisit at next meeting.
Chair: can we have it as working assumption? Samsung: no
Ericsson→ what will the outcomes of an email discussion be?
NO consensus.

CSI definition
R1-164399 Clarification on CSI measurements Qualcomm Incorporated
Decision: The document is noted.
R1-165542 Clarification of CSI measurements Qualcomm Incorporated (R1-164400)
Decision: The document is noted. Email discussion on the issue raised in R1-164399 and R1-165542 until June 10th

R1-164738 Draft CR on CSI Reporting Samsung
Decision: The document is noted. The first change in R1-164738 is endorsed. Final CR0674 to 36.213 is agreed in R1-165622

R1-164839 Correction on PDSCH transmission scheme assumed for TM9 CSI reference resource in TS 36.213 Huawei, HiSilicon
Decision: The document is noted. The change in R1-164839 is endorsed. Final CR0685 to 36.213 is agreed in R1-165737

R1-164739 Draft CR on A-CSI reporting for TM6 Samsung
Decision: The document is noted and the draft CR endorsed. Final CR0673 to 36.213 is agreed in R1-165621

SRS handling
R1-164841 Correction on SRS frequency location in TS 36.213 Huawei, HiSilicon
Decision: The document is noted. The change in R1-164841 is agreed in principle, further discussion offline especially regarding the wording. Final CR0678 to 36.213 is agreed in R1-165627

R1-165278 Channel interleaver correction for eMTC Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted and the CR is endorsed. Final CR0208 to 36.212 is agreed in R1-165635

Random access
R1-164836 Clarification on Msg3 PUSCH repetition level in TS 36.213 Huawei, HiSilicon
Decision: The document is noted and the CR is endorsed. Final CR0208 to 36.212 is agreed in R1-165626

R1-164865 Correction on the determining PRACH starting subframe in TS 36.211 Huawei, HiSilicon
Decision: The document is noted and the draft CR is postponed. Revisit in RAN1#86.

R1-165314 MCS for Random Access Response Grant Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is revised in:
R1-165579 MCS for Random Access Response Grant Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted and the draft CR is endorsed. Final CR0682 to 36.213 is agreed in R1-165687.

Paging occasion overlap
R1-164398 Discussion on paging occasion overlap for eMTC Qualcomm Incorporated
Decision: The document is noted and the topic is postponed. Revisit in RAN1#86.

R1-165543 Correction on DCI payload size Qualcomm
Decision: The document is noted.
R1-165646 Correcting configuration parameter for number of PRB-pairs Sequans Communications
Decision: The document is noted and the draft CR is endorsed. Final CR0680 to 36.213 is agreed in R1-165682

Not treated.
R1-165785 Draft 36.211 eMTC CR capturing RAN1 #84bis and #85 agreements Ericsson
R1-165786 Draft 36.212 eMTC CR capturing RAN1 #84bis and #85 agreements Ericsson
R1-165787 Draft 36.213 eMTC CR capturing RAN1 #84bis and #85 agreements Ericsson
R1-165993 CAT-M1 Coverage Enhancement Analysis Sierra Wireless, Ericsson, Sequans

6.1.6 Maintenance of Release 13 NB-IoT

R1-165933 Chairman's Notes of Agenda Item 6.1.6 on NB-IoT CRs Ad-hoc chair (Qualcomm)
The document was presented by Wanshi Chen from Qualcomm and provides the outcomes of NB-IoT maintenance session.
Decision: The document is endorsed. Contents incorporated below.

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R1-165111 Introduction of NB-IoT Motorola Mobility 36.213 13.1.1 CR0656 B
Decision: The document is already agreed (decision taken during email thread [84b-02].
R1-165396 36.201CR0014r1 Introduction of NB-IoT Nokia, Alcatel-Lucent Shanghai Bell 36.201 13.1.0 CR0014r1 B
Decision: The document is already agreed (decision taken during email thread [84b-02].

R1-165754 LS on RRM measurement for NB-IOT RAN4
RAN4 LS providing the definitions of NRSRP and NRSRQ.
Decision: The document is noted.
R1-165753 Reply LS on NB-IoT RRM requirements RAN4
Decision: The document is noted.
R1-165894 Response to LS on uplink transmission gap in NB-IoT RAN4
Decision: The document is noted.
R1-165895 LS on Tx Gaps for Frequency Error Correction RAN4
Decision: The document is noted.

R1-164026 Updated Draft NB-IoT CR to 36.213 post Busan Motorola Mobility Germany GmbH
R1-164305 Introduction of LTE Physical Layer Enhancements for NB-IoT Motorola Mobility Germany GmbH
R1-164662 Introduction of NB-IoT Ericsson
Decision: The document is noted and CR0033 to 36.214 is agreed.

PSS/SSS
R1-164403 Potential issues of NB-SSS in asynchronous deployment Qualcomm Incorporated
Decision: The document is noted.
Conclusion:
- There is no consensus to standardize a solution to address the issue identified in R1-164403 and there is no consensus to send an LS to RAN4.

SI Handling
R1-164863 On TBS values for NB-SI transmission Huawei, HiSilicon
Decision: The document is noted.
R1-165127 Remaining issue on SI messages for NB-IoT ZTE
Decision: The document is noted.
R1-165231 TBS values and resource mapping for SI messages Intel Corporation
Decision: The document is noted.
R1-165602 WF on TBS for NB-IoT SI-messages Huawei, HiSilicon, CATT, Ericsson, Intel, Nokia, ASB, QC, Sony, Vodafone
Decision: The document is noted. Also supported by MediaTek.

Agreement:
- It is feasible to support additional TBS of 56, and 120 bits for SI-messages (not including SIB1-NB)
- Recommend RAN2 to select:
  - $I_{SF} = 1$, $I_{TBS} = 1$ (for 56 bits); and
  - $I_{SF} = 1$, $I_{TBS} = 4$ (for 120 bits)
- Send an LS to RAN2 based on the above bullets, draft LS in R1-165694, agreed in R1-165710

R1-165663 WF on SI messages for NB-IoT ZTE, Nubia Technology
Decision: The document is noted.

NPDCCH
R1-164291 Monitoring of NPDCCH after NPDSCH/NPUSCH transmission Sony
Decision: The document is noted.

Agreement:
- An NB-IoT UE is required to monitor for NB-PDCCH for UL and DL grant 3 ms after the end of the NB-PUSCH transmission.
  - Up to the editor how to capture the bullet

R1-164404 On NPDCCH search space Qualcomm Incorporated
Decision: The document is noted.

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R1-165629 **WF on collision with SI transmission and overlapping NPDCCH search space** **Qualcomm, Ericsson, MediaTek, Huawei, Hisilicon, ZTE**
Decision: The document is noted.

Agreement:
- A UE is not required to monitor an NPDCCH search space that ends later than 4ms before the beginning of the next NPDCCH search space.
  - The above rule also applies to partial NPDCCH search space period.
- Subframes of NPDSCH/NPDCCH for unicast, paging, and RAR that overlap with SI transmission are postponed to the next valid DL subframes

R1-164847 **Clarification on NPDCCH monitoring in 36.213** **Huawei, HiSilicon**
Decision: The document is noted.

Agreement:
- Clarify that "the corresponding NB-PDSCH or NB-PUSCH transmission" includes the ACK/NACK transmission on NPUSCH format 2 scheduled in DCI Format N1.
- An NB-IoT UE that has received a NPDCCH order is not required to monitor NPDCCH for any further DL or UL grant during the time period between the end of the NPDCCH order and the start of the ordered NPRACH transmission.

R1-164877 **Discussion on Scheduling Delay with Transmission Gaps** **CMCC**
Decision: The document is noted.
R1-165139 **Discussion on starting subframe of NPDCCH search space** **MediaTek Inc.**
Decision: The document is noted.
R1-165670 **WF on NPDCCH starting subframe** **MediaTek, LGE, Huawei, HiSilicon**
Decision: The document is noted. Also supported by Samsung.

Agreement:
- The formula for starting subframe of NPDCCH is updated as $(10n_f + \lfloor n_s/2 \rfloor) \bmod T = \lfloor \alpha_{\text{Offset}} T \rfloor$ where
  - α_{offset} is signaled via RRC {0, 1/8, 1/4, 3/8}, i.e., α_{offset} is an UE-specific parameter configured by RRC for USS and cell-specific and PRACH resource specific parameter for CSS for RAR/Msg 3 re-tx/Msg 4

Send an LS to RAN2, draft LS in R1-165695 (to update "two additional parameters", potentially include other possible new parameters) – (Huawei)
R1-165695 **[DRAFT]LS on RRC parameter list for NB-IoT** **Huawei**
Decision: The document is noted, revised in R1-165709, which is endorsed. Final LS is agreed in R1-165906.
R1-165730 **L1 parameters list for NB-IoT** **Huawei**
Decision: The document is noted and included in R1-165906.

R1-165229 **Some remaining issues on NPDCCH related to TS 36.213** **Intel Corporation**
Decision: The document is noted.

Agreements:
- Adopt the recommended changes to Section 16.4.1 and Section 16.6 of TS 36.213 as indicated in Section 2 of R1-165229
- If the higher layer parameter NBIoT-Operation-mode (or operationMode) indicates in-band mode of operation (i.e., set to '00' or '01'), the starting OFDM symbol for NPDCCH ($l_{\text{NPDCCHStart}}$) is given by the higher layer parameter lteControlRegionSize.

PDSCH
R1-165228 **On resource allocation for SIB1-NB in TS 3.213** **Intel Corporation**
Decision: The document is noted.

Agreement: The proposed text change in R1-165228 is endorsed

R1-165230 **On scrambling initialization for NPDSCH** **Intel Corporation**
Decision: The document is noted.

Agreements:
- For NPDSCH carrying SIB1-NB, the scrambling is reinitialized at the first subframe carrying a repetition of the codeword.

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- For NPDSCH carrying SI messages other than SIB1-NB, the scrambling is reinitialized at the first subframe carrying a repetition of the codeword.

A/N Timing

R1-164100 Time reference for A/N transmission Huawei, HiSilicon
Decision: The document is noted.
R1-164126 Time domain resource allocation for NPUSCH with 1-bit A/N feedback Intel Corporation
Decision: The document is noted.
R1-165000 Time Reference for Ack/Nack Transmission Nokia, Alcatel-Lucent Shanghai Bell
Decision: The document is noted.
R1-165124 Remaining issues on UL Transmission reference for NB-IoT ZTE
Decision: The document is noted.

R1-165539 WF on time reference of ACK/NACK of NPDSCH Huawei, HiSilicon, CATT, Intel, Panasonic, u-blox, ZTE
Decision: The document is noted.
R1-165664 WF on time reference of ACK/NACK of NPDSCH Huawei, HiSilicon, CATT, Intel, Panasonic, u-blox, ZTE, Samsung, China Unicom, Astri, NEUL, CATR
Decision: The document is noted. Also supported by China Telecom, Potevio.
R1-165651 WF on Time Reference for Ack/Nack Transmission Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Sony, Verizon, AT&T, LG, Sierra Wireless
Decision: The document is noted.
R1-165884 WF on Time Reference for Ack/Nack Transmission Ericsson
Decision: The document is noted.

Agreements:

- A/N transmission delay is relative to the end of the corresponding NPDSCH transmission plus 12ms.
- Introduce both odd and even numbers for the time offset for 15 kHz ACK/NACK.
- It is proposed to use the following timing offsets in the DCI instead of {0, 2, 4, 6} ms for 15kHz ACK/NACK transmission.
  - {0 2 4 5}

DL & UL Gap

Decision: The document is noted.
R1-164290 UL Transmission Gap Duration Sony
Decision: The document is noted.
R1-164376 On UL transmission gaps and related RAN4 analysis Huawei, HiSilicon
Decision: The document is noted.
R1-165126 Potential issue on value of DL Gap configuration for NB-IoT ZTE
Decision: The document is noted.
R1-165131 Issues on NPRACH UL Gap configuration ZTE
Decision: The document is noted.
R1-165644 WF on clarification for timing of DL transmission ZTE, MTK, HW, HiSilicon, Sony
Decision: The document is noted.

Agreement: If NPUSCH UL Gap is inserted at the end of NPUSCH transmission, the UE resumes monitoring of N-PDCCH from the end of the UL gap.

R1-165645 WF on NPRACH UL gap ZTE, MTK,Sony
Decision: The document is noted.

Agreement: If a NPRACH UL Gap is inserted at the end of NPRACH opportunity, the start of RAR detecting window is from the end of the UL gap.

RACH

R1-164862 Clarification on UL grant in NB-RAR in 36.213 Huawei, HiSilicon
Decision: The document is noted.

Agreement: When $I_{delay} = 0$ for UL grant in NB-RAR, $k_0 = 13$.

R1-164939 Clarification on repetition and Pseudo-random hopping of NPRACH NEC Corporation
Decision: The document is noted.

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R1-165355 **NB-IoT-NPDCCH ordered PRACH** **Ericsson**
Decision: The document is noted.
R1-165652 **WF on NPDCCH ordered PRACH** **Ericsson**
Decision: The document is noted. Also supported by ZTE.

Agreement:
- Introduce the tone index in DCI format N1 for the NPDCCH ordered PRACH.
- A field of 6 bits in DCI format N1 should be used to indicate the tone index as
  - Indicate the absolute tone index.
  - The tone index in DCI format N1 has to indicate a tone in a PRACH resource matching the PRACH repetitions.
    - A tone outside this PRACH resource is not allowed.

PUSCH
R1-164998 **Handling of cyclic shift in UL DMRS sequence selection** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
R1-165130 **Comments on NPUSCH format 1 and TP for 36.213** **ZTE**
Decision: The document is noted.

Conclusion: The TP in R1-165130 is endorsed

R1-165128 **Remaining issues on DMRS for NPUSCH format 2** **ZTE**
Decision: The document is noted.

R1-165630 **WF on NB-IoT UL DMRS Hopping** **Qualcomm**
Decision: The document is noted. Also supported by Panasonic.

Agreements:
- To adopt the legacy LTE group hopping, as defined in Sec. 5.5.1.3, TS36.211, for NB-IoT UL DMRS for N-PUSCH format 1:
  - The group hopping pattern is revised from legacy LTE with *30* replaced by M in the following equations
    - $u = \left(f_{gh}(n_s) + f_{ss}\right) \bmod M$
    - $f_{gh}(n_s) = \begin{cases} 0 & \text{if group hopping is disabled} \\ \left(\sum_{i=0}^{7} c(8n_s + i) \cdot 2^i\right) \bmod M & \text{if group hopping is enabled} \end{cases}$
    - $c_{init} = \left\lfloor \frac{n_{ID}^{RS}}{M} \right\rfloor$
    - $f_{ss}^{PUSCH} = \left(N_{ID}^{cell} + \Delta_{ss}\right) \bmod M$
    - $f_{ss}^{PUSCH} = n_{ID}^{RS} \bmod M$
  - In the above, M=30, 14, 12, and 16 for, respectively, 12-tones, 6-tone, 3-tone and single-tone cases.
  - The group-hopping pattern is reset:
    - Every subframe for multi-tone transmission
    - Every RU for single-tone transmission
  - The group-hopping for single-tone transmission only applies to the Hadmard sequence index
  - n_{ID}^{PUSCH} is not defined, and $n_{ID}^{RS} = N_{ID}^{Ncell}$.
- Send an LS to RAN2 (cc-RAN4) to inform the above including the need to have
  - a new cell-specific RRC parameter, Group-hopping-enabled, to enable and disable the group hopping,
  - a new UE-specific RRC parameter, Disable-group-hopping to disable the function despite it is enabled by the cell-specific parameter unless the PUSCH transmission corresponds to a Random Access Response Grant or a retransmission of the same transport block as part of the contention based random access procedure,
  - a new RRC parameter for the offset, Δ_{ss} (the same range of the one in LTE)

Post meeting: It is noticed that LS sent to RAN2 did not include RAN4 – see email thread [85-26].

Collision Handling
R1-164846 **Clarifications on collision handling in 36.211 and 36.213** **Huawei, HiSilicon**
Decision: The document is noted.
R1-164991 **NB-IoT - Collision handling** **Ericsson**
Decision: The document is noted.
R1-165125 **Collision handling for NB-IoT** **ZTE**
Decision: The document is noted.

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R1-165132 **On collision between NPRACH and NPUSCH** **ZTE**
Decision: The document is noted.

General/Multiple
R1-164493 **Discussion on remaining issues on NB-IoT** **LG Electronics**
Decision: The document is noted.

Agreement:
- When a UE is configured with additional PRB in inband where anchor PRB is in guard band
  - If same-PCI indicator is true, the behaviour is defined the same in all cases
  - If same-PCI indicator is not true, the behaviour is defined the same in all cases

R1-164494 **Discussion and comments on NB-IoT CRs** **LG Electronics**
Decision: The document is noted.

Agreement:
- Introduce the following definition in 36.211:
  - N: A constant equal to 2048 for Δf=15kHz , 4096 for Δf=7.5kHz and 8192 for Δf=3.75kHz

R1-164577 **Clarifications for NB-IoT CRs** **Spreadtrum Communications**
Decision: The document is noted. The first change in R1-164577 is to be handled by the editor.

R1-165002 **Non-anchor PRB location for NB-IoT multi-carrier operation** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
R1-165129 **Comments on UE procedures for NB-IoT and TP for 36.213** **ZTE**
Decision: The document is noted.

Agreement: The TP in R1-165129 is endorsed

Others
R1-164848 **Draft 36.300 section 5 CR for NB-IoT** **Huawei**
Decision: The document is noted.

Agreement:
- The draft CR in R1-164848 is endorsed (removing the changes on changes), send an LS to RAN2 – (Huawei)
- **R1-165600** (the updated CR)
- The draft LS is in R1-165601, with the final LS agreed in R1-165711

R1-164917 **Clarification of antenna port usage of NB-IoT** **Panasonic Corporation**
Decision: The document is noted.

Agreement:
- When the same-PCI indicator is set to true, to use antenna port 0 and 1 for the transmission of NRS, NPDCCH, NPDSCH and NBPCH. When the same-PCI indicator is set to false, to use new antenna port (for example port 1000 and 1001) for the transmission of NRS, NPDCCH, NPDSCH and NBPCH.
  - How to capture the bullet is up to the editor
- A UE may assume the antenna ports 1000 – 1001 of a serving cell are quasi co-located (as currently defined in 36.213 that is to introduced in 36.211) with respect to delay spread, Doppler spread, Doppler shift, average gain, and average delay.
  - How to capture the bullet is up to the editor

R1-165879 **WF on NPDCCH search space monitoring** **MediaTek, Nokia, Huawei, Hisilicon, Qualcomm, Sony, ZTE**
Decision: The document is noted.

Agreement:
- UE is not required to simultaneously monitor CSS for paging and CSS for RAR/Msg 3 re-tx/Msg 4.

R1-165949 **WF on NPUSCH format 2 Phase Rotation** **ZTE**
Decision: The document is noted.

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- ZTE: it is noted for single-tone modulation, the waveform phase transition requirement agreed in previous meeting does not apply for NPUSCH format 2.

Not treated.
R1-165683 On NSSS design and SFN index detection ambiguity Intel Corporation
R1-165747 WF on NB-IoT Multi-PRB operation LG Electronics, Nokia, ASB
R1-165788 WF on NB-IoT UL DMRS Hopping Qualcomm

Friday

R1-165985 WF on UL gaps for NB-IoT Huawei, HiSilicon, Sony, Ericsson, MediaTek, Vodafone, ZTE, Nubia Technology, Spreadtrum, u-blox
Decision: The document is noted. Revised in:
R1-166023 WF on UL gaps for NB-IoT Huawei, HiSilicon, CATT, Ericsson, Intel, MediaTek, Nokia, Samsung, Sony, u-blox, Vodafone, ZTE, Nubia Technologies
Decision: The document is agreed.

R1-166009 [DRAFT]LS on NB-IoT Performance Huawei, HiSilicon, Vodafone, Deutsche Telekom, CMCC, China Telecom, China Unicom, NTT DOCOMO
Decision: The document is noted, revised in R1-166024. Further revised in:
R1-166036 [DRAFT]LS on NB-IoT Performance Huawei, HiSilicon, Vodafone, Deutsche Telekom, CMCC, China Telecom, China Unicom, NTT DOCOMO
Decision: The document is noted and final LS is agreed in R1-166037.

Rapporteur shall submit the list of all agreements by May 30th.
Editors will provide updated NB-IoT CRs to 36.211, 36.212, 36.213 and 36.214 by June 3rd , for email approval by June 7th.

6.1.7 Other

R1-165093 Correction on search space to decode the PDCCH configured by the SC-N-RNTI TD Tech Ltd
36.213 13.1.1 LTE_SC_PTM-Core CR0654 F
If a UE is configured by higher layers to decode PDCCH with CRC scrambled by the SC-N-RNTI, the UE shall monitor common search space to decode the PDCCH with CRC scrambled by the SC-N-RNTI.
Decision: The document is noted and CR0654 to 36.213 is agreed.

R1-165168 Introduction of 60ms periodicity for wideband CQI/PMI reporting Nokia, Alcatel-Lucent Shanghai Bell, Apple, Broadcom, Ericsson, Intel, Mediatek 36.213 13.1.1 TEI13 draftCR B
Tables 7.2.2-1A and 7.2.2-1C are modified so that some of the currently reserved $I_{CQI/PMI}$ values are used to define 60ms CQI/PMI reporting periodicity and associated offsets.
Decision: The document is noted and agreed as CR0668 to 36.213 in R1-165530.

6.2 LTE Release 14

6.2.1 Enhanced Licensed-Assisted Access to Unlicensed Spectrum - *WID in RP-152272*.

R1-165934 Chairman's Notes of Agenda Item 6.2.1 on eLAA Ad-hoc chair (Qualcomm) Ad-hoc chair (Nokia, Ericsson)
The document was presented by Wanshi Chen from Qualcomm and provides the outcomes of the eLAA session.
Decision: The document is endorsed. Contents incorporated below.

Email approval about following yellow colour parts until 6th June – Havish (Ericsson)

Editors will submit draft CRs (201, 211, 212, 213, 214 (if needed)) until 18th August
Rapporteur needs to submit agreement and WA lists until 30th June

6.2.1.1 *PUSCH design*

TPC and PHR
R1-164576 TPC and PHR for UL LAA ZTE
R1-164287 Power headroom report enhancement for eLAA Sony
R1-164742 Discussion on UL power issues for eLAA Samsung
R1-164918 On PUSCH Transmit Power on LAA SCells Nokia, Alcatel-Lucent Shanghai Bell

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R1-165557 WF on Uplink Power Control in eLAA, LGE, ZTE and Nubia

Agreement:
- UE's path-loss calculation for the open loop power control for uplink is based on the CRS in DRS within DMTC
  - Note: There may be no specification impact

Agreement:
- PHR for a subframe shall be calculated based on the scheduled uplink transmissions in LAA SCells regardless of whether the actual transmission is performed or not performed

Resource Allocation for eLAA

R1-164055 Resource allocation for RB interleaved PUSCH for eLAA Huawei, HiSilicon
R1-164128 Remaining details on resource allocation for eLAA PUSCH transmission Intel Corporation
R1-164406 PUSCH design details Qualcomm Incorporated
R1-164408 PUSCH resource allocation granularity Qualcomm Incorporated
R1-164479 Remaining issues on PUSCH resource allocation NEC
R1-164495 PUSCH resource allocation in LAALG Electronics
R1-164574 On UL Resource Allocation for PUSCH ZTE
R1-164740 UL Waveform for PUSCH Samsung
R1-164831 Discussion on equal and non-equal multi-interlace based PUSCH structure Huawei, HiSilicon
R1-164919 PUSCH Resource Allocation Details Nokia, Alcatel-Lucent Shanghai Bell
R1-164993 Resource allocation of PUSCH for eLAA Sharp
R1-165115 Considerations on eLAA PUSCH design Mediatek
R1-165141 Uplink Resource Allocation Design for Enhanced LAA Ericsson
R1-165185 Discussion on PUSCH subframe structure and resource allocation for eLAA UL NTT DOCOMO INC.

R1-165817 Response LS on PUSCH transmission for eLAA RAN4, Nokia

R1-165800 WF on PUSCH resource allocation for eLAA Huawei, HiSilicon, Intel, Qualcomm, NTT DOCOMO, LGE

Agreement
- Confirm the previous working assumption
  - the 10RBs are spaced equally in frequency domain for 20MHz
    - Example for 20MHz eLAA SCell: interlace 0 is composed of RBs 0,10,20,...,90
    - Scheduling 70 UL RBs is not supported

Agreement
- One interlace is composed of 10RB/interlace for 10MHz

Possible agreement:
- Companies are encouraged to provide their preference on the RA alternatives
  - Alt 1: UL resource allocation type 0
  - Alt 2: bitmap based resource allocation
  - Alt 3: predefined resource allocation patterns with the number of bits being same or less than Alt. 1
    - Define all contiguous patterns + the patterns in the set [0+5, 1+6, ….]
    - Define all contiguous patterns + other patterns
      - Examples provided in R1-164055
    - Define some number of patterns based on the number of interlaces allocated
      - More patterns for fewer interlaces
  - Alt 4: RRC configure between Alt 1 and Alt 2

Scheduling, HARQ, Signaling

R1-164497 Summary of email discussion on multi-subframe scheduling LG Electronics

R1-164075 Multi-subframe scheduling design for eLAA Huawei, HiSilicon
R1-164127 On the DCI design for multi-subframe scheduling Intel Corporation

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R1-164197	PUSCH scheduling for Rel-14 eLAA	CATT
R1-164319	eLAA PUSCH transmission	Fujitsu
R1-164407	PUSCH and SRS multiplexing	Qualcomm Incorporated
R1-164409	Control details for UL scheduling	Qualcomm Incorporated
R1-164410	DCI design for PUSCH scheduling in eLAA	Qualcomm Incorporated
R1-164480	Remaining details on multiple-subframe scheduling for LAA	NEC
R1-164496	Multi-subframe scheduling in LAA	LG Electronics
R1-164572	HARQ for UL LAA	ZTE
R1-164573	Consideration of LBT failure in LAA UL HARQ operation	ZTE
R1-164575	Discussion on UL scheduling for LAA	ZTE
R1-164578	Discussion on UL Grant Transmission for eLAA	Spreadtrum Communications
R1-164595	WF on UL scheduling and transmission for LAA	ZTE
R1-164717	Multi-subframe scheduling for eLAA	Kyocera Corporation
R1-164741	Multi-subframe scheduling for PUSCH	Samsung
R1-164743	Discussion on scheduling options for eLAA	Samsung
R1-164745	Further Discussion on PUSCH DTX Handling for eLAA	Samsung
R1-164828	Discussion on PUSCH transmission starting within symbol #0	Huawei, HiSilicon
R1-164829	PHY signaling design for eLAA	Huawei, HiSilicon
R1-164928	Discussion on scheduling combinations for eLAA	ITRI
R1-164940	On LAA UL/DL Scheduling Combinations	Nokia, Alcatel-Lucent Shanghai Bell
R1-164941	eLAA UL scheduling / UL grant details	Nokia, Alcatel-Lucent Shanghai Bell
R1-164942	On Two-Stage UL scheduling for eLAA	Nokia, Alcatel-Lucent Shanghai Bell
R1-164992	DCI design for multiple-subframe scheduling for LAA UL	Sharp
R1-165116	Control channel design for eLAA	Mediatek
R1-165142	Multi-subframe scheduling design for Enhanced LAA	Ericsson
R1-165186	Discussion on UL scheduling design for eLAA	NTT DOCOMO, INC.
R1-165247	Remaining details of multi-subframe scheduling for eLAA	ETRI

Agreement:
- For LAA uplink, DCI 0B and DCI 4B can schedule PUSCH transmission in maximum N_sf subframes, where N_sf is configurable by UE-specific RRC
  - DCI 0B: DCI format supporting PUSCH multi-subframe scheduling with TM1 for LAA SCell
  - DCI 4B: DCI format supporting PUSCH multi-subframe scheduling with TM2 for LAA SCell
  - N_sf value range is N_min to N_max
  - Value of N_min: 2
  - Value of N_max is 4
  - DCI payload sizes of DCI 0B and DCI 4B are decided by configured N_sf value
  - RRC signalling can enable or disable DCI 0B and DCI 4B independently

Agreement:
- UE may be configured to detect multiple uplink grants which may be chosen without restriction from DCI 0A/4A/0B/4B
  - Maximum number of uplink grants to be transmitted for a single UE in a subframe is 4
  - DCI 0A: DCI format supporting PUSCH single-subframe scheduling with TM1 for LAA SCell
  - DCI 4A: DCI format supporting PUSCH single-subframe scheduling with TM2 for LAA SCell

Working assumption:
- The new DCI formats along with all the applicable legacy DCI formats are subject to the blind decoding reduction mechanisms defined in Rel-13.
  - FFS: Whether any further enhancements to the reduction mechanisms on a per DCI format basis is necessary

R1-166003 Way Forward on managing UE blind decoding for LAA SCells in Rel-14 eLAA Qualcomm

Agreement:
- A single UL grant scheduling multiple subframes can only schedule consecutive subframes for PUSCH transmission

Agreement:
- The following scheduling information in the existing DCI format 0/4 are not included in DCI 0A/4A/0B/4B for LAA when an interlace structure is used
  - frequency hopping, resource allocation type

Possible agreement:

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- RRC signalling can configure whether resource allocation is based on an interlace structure or on legacy structures
- RAN1 recommends that the support of resource allocation based on an interlace resource allocation structure for DCI 0A/4A/0B/4B is mandatory.
- RAN1 recommends that the support of resource allocation based on the legacy resource allocation structure for DCI 0A/4A/0B/4B is optional

Agreement:

- There is only one SRS transmission request per DCI 0A/4A/0B/4B

R1-165822 Second WF on Multi-subframe scheduling in LAA, LGE, ZTE

Agreements:

- DCI format 0B/4B indicates number of scheduled subframes
- DCI format 0B/4B indicates HARQ process IDs for the scheduled subframes by indicating HARQ process ID for a single subframe, and HARQp_ids for other subframes are derived by a given rule
  - the HARQp_ids for other subframes are consecutive with the indicated HARQ process IDs, modulo max number of HARQ processes
- DCI format 0B/4B indicates RVs for the scheduled subframes by indicating a 1-bit RV value per scheduled subframe (regardless of the number of scheduled transport blocks)
  - Can indicate RV 0 or 2

Agreements:

- For MSF DCI format 4B, utilise the current 2-bit SRS triggering field; include SRS subframe indication in the SRS parameter set configuration
- For MSF DCI format 0B, existing SRS triggering bit and 1 additional bit are used for SRS triggering and subframe indication
  - The 4 states are defined in specs as no triggering, first, second or last subframe
- Ending PUSCH DFT-S-OFDM symbol in a DCI format 0B/4B applies only to the last scheduled subframe
- CSI request in DCI format 0B/4B applies to 2nd scheduled subframe if Nmax=2, and otherwise to the penultimate scheduled subframe
- CSI reference subframe is defined according to the existing rules in 36.213 s.7.2.3.
- In case the subframe in which CSI would be transmitted is not transmitted because LBT does not succeed, CSI shall not be transmitted
- MCS for each codeword in DCI format 4B is indicated separately
- Timing offset is counted from subframe N+4+k, and k is signalled with (working assumption 3)bits ([0….7] SFs) (FFS in case of 2-step scheduling)
- Working assumption (automatically confirmed if no problem identified by the end of the meeting): Common MCS value in DCI format 0B/4B applies to the PUSCH containing UCI and/or SRS and/or blanked symbol(s) without special handling

Discuss separately:

- RRC configures the max number of HARQ processes, up to 16

Agreement:

- eNB signals LBT type at least including 25us single slot LBT and Cat4 LBT to the UE at least for PUSCH

R1-165647 WF on eLAA UL/DL scheduling combinations Nokia, Alcatel-Lucent Shanghai Bell, CATT, LG Electronics, NTT DOCOMO, Qualcomm, Intel, Ericsson, ZTE, Fujitsu, ETRI, ITL, Huawei, HiSilicon, Samsung, Kyocera, Panasonic

Agreements:

- **Support UL/DL Scheduling Combination 2: Self-scheduling on DL and cross-carrier scheduling on UL**
  - The UE to monitor for DCI formats scheduling PUSCH of a single eLAA Scell on one UL licensed-band scheduling cell
    - i.e. DCI formats 0A/0B, Formats 4A/4B if configured for TM2
  - The UE to monitor for DCI formats scheduling LAA PDSCH on the LAA SCell
    - i.e. DCI formats 1A/1B/1D/1/2A/2/2B/2C/2D
  - Configuration details of enabling self-scheduling on DL and cross-carrier scheduling on UL are up to RAN2
  - FFS: If UCI cell groups concept is agreed, then whether scheduling is allowed from outside the UCI cell group
  - FFS: Whether cross-carrier transmissions of DCI scheduling on the UL is only applicable to PUSCH scheduling or whether it may be applicable to all the UL DCIs for the UL (e.g. if agreed, DCI for SRS triggering etc).

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– FFS: How to manage the number of blind decodes at the UE side in general (equally applicable for other scheduling combinations)?

R1-165649 WF on PSCH HARQ Huawei

PUSCH structure
R1-164744 Remaining issues on PUSCH design for eLAA Samsung
R1-165033 Uplink Subframe Structure Panasonic
R1-165143 Performance impact of UL short LBT periods in symbol #0 Ericsson
R1-165144 Solutions supporting UL short LBT period in Symbol #0 Ericsson

R1-165963

R1-165883 WF on initial signal transmission in LAA, LGE, Huawei, HiSilicon, ZTE

R1-165717 WF on PUSCH transmissions on an LAA Scell and PUCCH transmissions, Ericsson

Agreement:

Timing of 25 us gap immediately before transmission of PUSCH and SRS for 25 us LBT is decided by the eNB and is indicated to the UE

Agreement:

Transmission time for PUSCH and SRS after a Cat. 4 LBT at the UE is decided by the eNB and is indicated to the UE.

- Note: There is no restriction on when the UE starts cat. 4 LBT
- Note: If the UE fails to complete Cat. 4 LBT for the first subframe in a multi-subframe UL grant, it can continue the Cat. 4 LBT procedure and attempt transmission for subsequent subframes.

Possible offline agreement:

Transmission on UL is allowed to start at the following times in a UL subframe

- Start of DFTS-OFDM symbol 0
- Start of DFTS-OFDM symbol 1
- 25 us + TA value after start of DFTS-OFDM symbol 0
- 25 us after start of last DFTS-OFDM symbol of previous subframe
- FFS: 16 us + TA after start of DFTS-OFDM symbol 0
- Note: Gaps may be created by UE subframe timing adjustment instead of using a partial OFDM symbol if a TA offset is dynamically signaled

Other
R1-165145 On Power Spectral Density Regulations for Enhanced LAA Transmissions Ericsson

6.2.1.2 SRS design

R1-164129 Remaining details of SRS transmission for eLAA Intel Corporation
R1-164719 SRS design for eLAA Kyocera Corporation
R1-164411 SRS procedures for eLAA Qualcomm Incorporated
R1-164814 SRS waveform Huawei, HiSilicon

R1-165565 WF on LBT scheme for SRS transmission on LAA SCell LGE, ITL, Sharp Dependent on RCOT WF
- DL grant triggering aperiodic SRS that is not multiplexed with PUSCH signals LBT type for SRS transmission

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  - LBT type includes at least 25 usec one-shot LBT or Cat 4 LBT.
  - FFS: If aperiodic SRS is followed by PUSCH without gap between SRS and PUSCH, UE performs LBT indicated for the following PUSCH.

- If Cat 3 or Cat 4 LBT is performed for aperiodic SRS that is not multiplexed with PUSCH and without PUSCH in following subframe, the highest LBT priority class with only the minimum contention window size [3] can be considered for LBT purposes.

Proposal:
- Cat 4 LBT with the highest priority is performed for aperiodic SRS that is not multiplexed with PUSCH and without PUSCH in following subframe,

R1-165572 WF on general SRS aspects
Agreement:
- Periodic SRS is NOT supported in Rel-14 eLAA WI
- Cell-specific and UE-specific SRS subframe configuration in RRC signaling for both periodic and aperiodic SRS is not applicable in the current scope of Rel-14 eLAA

Agreement:
- SRS uses the legacy comb structure

Agreement:
- Keep the existing max # SRS RBs for a given system bandwidth
  - No shifting of SRS is used on an LAA SCell

R1-165573 WF on transmission and triggering SRS without PUSCH, Huawei, HiSilicon, Qualcomm, Samsung, ZTE, Intel, ITL, Nokia, ALU, Ericsson
Agreement:
- When SRS without PUSCH is transmitted in DL ending partial subframes, UE transmits SRS in symbol 13

Options for triggering of SRS transmissions:
1) SRS without PUSCH is transmitted in subframe n+4 if the DL grant triggering the SRS transmission is received in subframe n (default if no other options are agreed)
2) SRS is transmitted according to one of the two options
   a. in a DL ending partial subframe n+4 if a DL grant triggering SRS transmission is received in subframe <= n
   b. in a subframe n+4 immediately following a DL subframe, if a DL grant triggering SRS transmission is received in subframe <= n and no DL ending partial subframe is present between the DL grant and subframe n+4
3) SRS without PUSCH is transmitted in subframe n+k if the DL grant triggering the SRS transmission is received in subframe n.
   a. The parameter k is indicated in the DL grant

Proposal:
- Common/Group DCI can be used to trigger a-SRS without PUSCH for a group of UEs on the LAA Scell
- The triggering signaling includes the following fields
  - Subframe timing k. This field will be omitted if subframe timing is predefined.
  - FFS SRS LBT type, e.g., cat.2/cat.4
    - Depends on whether or not the UE knows of the MCOT
  - CIF, if cross carrier indication from PCell is supported
  - UE-specific field: trigger or not
- The group ID/RNTI is configured to the UE via RRC signaling

R1-164074 SRS configurations for eLAA Huawei, HiSilicon
R1-164288 LBT operation for SRS in eLAA Sony
R1-164498 SRS transmission in LAA LG Electronics
R1-164579 Discussion on the remaining issues for SRS transmission in eLAA Spreadtrum Communications
R1-164596 Discussion on SRS design for eLAA UL ZTE
R1-164746 Remaining issues of SRS transmission Samsung

R1-164986 Remaining issues on aperiodic SRS transmission without PUSCH Nokia, Alcatel-Lucent Shanghai Bell
R1-164987 Remaining issues on LAA SRS with PUSCH allocation Nokia, Alcatel-Lucent Shanghai Bell

R1-165117 SRS design for LAA Mediatek
R1-165146 On SRS Design for Enhanced LAA Ericsson
R1-165187 Discussion on SRS design for eLAA UL NTT DOCOMO, INC.
R1-165239 SRS design in Rel-14 eLAA Innovative Technology Lab Co.
R1-165248 Remaining details of SRS transmission on eLAA ETRI

6.2.1.3 Uplink control information on an LAA SCell

R1-165147 Summary of Email Discussion [84b-05] on UCI Transmission for Enhanced LAA Ericsson

R1-164747 UCI Transmission on LAA Scell Samsung
R1-164198 UCI transmission for Rel-14 eLAA CATT
R1-165188 Discussion on UCI transmission for eLAA UL NTT DOCOMO, INC.
R1-165150 Solutions supporting large HARQ-ACK payloads multiplexed with PUSCH Ericsson

Agreement:
- A UE may be configured with simultaneous PUSCH/PUCCH in licensed spectrum or without simultaneous PUSCH/PUCCH in licensed spectrum independently from the configuration of an LAA Scell for the UE

Agreement:
- An LAA SCell for UL is configured to the UE only if simultaneous PUCCH in licensed spectrum and LAA SCell PUSCH transmission is supported by the UE

R1-164076 UCI transmission for eLAA Huawei, HiSilicon
R1-164130 UCI transmission for eLAA Scells Intel Corporation
R1-164412 UCI reporting on unlicensed carriers Qualcomm Incorporated
R1-164499 UCI transmission in LAA LG Electronics
R1-164598 Discussion on UCI transmission on LAA SCell ZTE
R1-164647 UCI transmission on LAA Scell Lenovo (Beijing) Ltd
R1-164920 UCI Transmission on LAA SCells Nokia, Alcatel-Lucent Shanghai Bell
R1-164994 UCI transmission on LAA carrier Sharp
R1-165118 UCI transmission in LAA Mediatek
R1-165148 On the Transmission of Uplink Control Information for Enhanced LAA Ericsson
R1-165149 Performance impact of large HARQ-ACK payloads multiplexed with PUSCH Ericsson
R1-165251 HARQ-ACK transmission on LAA SCell PUSCH for eLAA WILUS Inc.

6.2.1.4 PRACH design

R1-165169 Discussion on PRACH for eLAA Shenzhen Coolpad Technologies
R1-165119 Considerations on PRACH design in eLAA Mediatek
R1-164077 PRACH waveform for eLAA Huawei, HiSilicon
R1-164131 PRACH transmission for eLAA Intel Corporation
R1-164413 PRACH waveforms for eLAA Qualcomm Incorporated
R1-164988 Discussion on PRACH design for eLAA Nokia, Alcatel-Lucent Shanghai Bell

R1-164078 PRACH configurations for eLAA Huawei, HiSilicon
R1-164199 PRACH design for Rel-14 eLAA CATT
R1-164414 PRACH procedures for eLAA Qualcomm Incorporated
R1-164500 Random access preamble in LAA LG Electronics
R1-164501 Random access procedure in LAA LG Electronics
R1-164600 PRACH Design for LAA ZTE
R1-164748 PRACH Transmission for UL LAA Samsung
R1-164749 Discussion on random access procedure for eLAA Samsung
R1-164830 Evaluation for PRACH waveform for eLAA Huawei, HiSilicon
R1-164904 Discussion on PRACH design for LAA HTC

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R1-164989 Performance Evaluation of PRACH for eLAA Nokia, Alcatel-Lucent Shanghai Bell
R1-165034 PRACH Bandwidth on Unlicensed Carriers Panasonic
R1-165070 Performance Evaluation for PRACH for eLAA Intel Corporation
R1-165151 PRACH Design for Enhanced LAA Ericsson
R1-165152 On Performance of PRACH for Enhanced LAA Ericsson
R1-165189 Discussion on PRACH for eLAA UL NTT DOCOMO, INC.

R1-165498 WF on PRACH Ericsson

Conclusion:
- Several possible approaches have been identified for the PRACH
- PRACH is useful in some use cases
- Enhanced LAA can operate without PRACH at least in scenarios with limited separation between base stations on licensed and unlicensed carriers, if the initial values of timing advance and power control are defined, e.g. if the licensed and unlicensed carriers are in the same TAG

R1-165574 WF on PRACH configuration

6.2.1.5 Channel access framework

R1-164990 Channel Access for LAA UL Nokia, Alcatel-Lucent Shanghai Bell

R1-164073 Contention window size adjustment for UL category 4 LBT for eLAA Huawei, HiSilicon

Possible agreement:
Contention window maintenance for UL Category 4 LBT is done per UE

Options for LBT priority class handling when UE performs Category 4 LBT:
Option 1: Signalling of LBT priority class from eNB to UE determines for its Cat. 4 LBT
- Buffer status report from UE allows eNB to determine what LBT priority class the UE intends to use for its category 4 LBT
- eNB schedules subframes and gaps according to its determination and signals priority class or contention window size (FFS between the two) to the UE
- UE follows the signalled LBT parameters for UL LBT for Category 4 LBT
- UE is allowed to use LCP for the allocated subframes regardless of LBT priority class that was used for UL LBT

Don't like this approach: Mediatek, Broadcom, Intel, Marvell, Cablelabs

Option 2: No signalling of LBT parameters for category 4 LBT at the UE from eNB and UE determines all Cat. 4 LBT parameters
- Buffer status report from UE allows eNB to determine what LBT priority class the UE intends to use for its category 4 LBT
- eNB schedules subframes and gaps according to its determination
- UE determines all category 4 LBT parameters for UL LBT for the allocated UL subframes based on traffic type of the data sent in the allocated subframes and the number of subframes it has been allocated

Don't like this approach: Qualcomm, LG, ZTE, Samsung, ETRI, Sharp

R1-165812 WF on ED threshold Ericsson
- Align the requirement on the energy detection threshold for UL transmission with the corresponding Rel-13 LAA requirements for PDSCH transmission.
  - The maximum transmit power per carrier configured to the UE is used to set the ED threshold

R1-165962 WF on ED Threshold for UL LBT Ericsson, Huawei, HiSilicon

R1-165715 WF on LBT Priority Class for UL Transmissions Ericsson, Intel, ZTE, Nokia, ALU, ASB, III, Huawei, HiSilicon

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R1-165890 Way Forward on determining UL LBT priority class Mediatek

WF on DL+UL Traffic Multiplexing for eLAA Broadcom, BlackBerry, CableLabs, Orange, Marvell

- *For a ~~DL~~ transmission burst with PDSCH(s) and/or PUSCH(s) scheduled by the eNB for which channel access has been obtained using Channel Access Priority Class P (1…4), E-UTRAN shall ensure the following where ~~a DL~~ transmission burst refers to ~~the continuous~~ DL transmissions from the eNB and all scheduled UL transmissions from the UEs starting after a successful LBT:*
  - *the transmission duration of the ~~DL~~ transmission burst shall not exceed the minimum duration needed to transmit all available buffered traffic corresponding to Channel Access Priority Class(es) ≤ P;*
    NOTE: the buffered traffic includes all ~~the~~ available traffic in DL at the eNB and all traffic available for transmission at all scheduled UEs as per the latest buffer status information from each UE (see [ref 13 in 36.300])
  - *the transmission duration of the ~~DL~~ transmission burst shall not exceed the Maximum Channel Occupancy Time (as defined in Table 15.1.1-1 of [ref 6 in 36.300]) for Channel Access Priority Class P;*
    - *additional traffic corresponding to Channel Access Priority Class(es) > P may only be included in the ~~DL~~ transmission burst once no more ~~data~~ buffered traffic corresponding to Channel Access Priority Class(es) ≤ P is available for transmission and the transmission duration of the transmission burst as defined above has not yet expired. In such cases, E-UTRAN should maximise occupancy of the remaining transmission resources in the ~~DL~~ transmission burst with this additional traffic.*

Note: Additions to the agreements made in Rel 13 LAA are marked in Green while deletions are marked in Red with strikethrough.

R1-165838 LS to RAN1 on RAN2 agreement on eLAA RAN2

R1-165897 WF on the determination of LBT priority class at the UE Nokia, Alcatel-Lucent Shanghai Bell

Agreement:

- When the UE performs Cat. 4 LBT, it uses the priority class signaled by the eNB
  - There is no additional restriction at the UE (other than the multiplexing rules defined in RAN2) on the type of the traffic that can be carried in the scheduled subframes.
  - eNB shall not schedule the UE more subframes than what is needed to transmit all the traffic corresponding to the same LBT priority class or lower (i.e., with a lower number in the LBT priority class table) than the signaled LBT priority class based on the latest BSR and received UL traffic from the UE.
  - The eNB is responsible for making sure that the mapping between QCI and LBT priority class is consistent with section 5.7.1 in TS 36.300.
    - The eNB is expected to take the QCI with the lowest priority in the logical channel group into account when defining the LBT priority class for a logical channel group

R1-165927 WF on UL ED Threshold CableLabs

R1-165121 On priority classes for uplink LBT Mediatek

R1-165323 Discussion on LAA UL no LBT BROADCOM LIMITED
R1-165156 On Support of Conditional UL Transmissions without LBT Ericsson

R1-164133 UL grant transmission Intel Corporation

R1-165948 WF on the CWS adjustment at the UE for Cat-4 LBT Nokia, Alcatel-Lucent Shanghai Bell, Ericsson, Broadcom

R1-165752 WF on CWS adjustment for category 4 UL LBT in eLAA, LG Electronics, Sharp

Possible offline agreement:

- For category 4 LBT for PUSCH transmission on LAA SCell,
  - CWS is managed by eNB and indicated by UL grant.
  - CWS is adjusted per UE based on whether or not reference subframe is successfully decoded.
    - Reference subframe is the starting subframe of the most recent UL transmission burst for which a Cat. 4 LBT was expected to be used, for which DM-RS or SRS transmission from the UE is detected and PUSCH decoding is completed.
  - If at least one of the TBs in the reference subframe is successfully decoded, the CWS is reset for all priority classes; otherwise, it is increased to the next higher value for all priority classes.

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– The CWS is reset to the minimum value if the maximum CWS is used for K consecutive LBT attempts for transmission only for the priority class for which maximum CWS is used for K consecutive LBT attempts.
  - K is selected by eNB implementation from the set of values from (1, …,8).

Possible offline agreement:

- For category 4 LBT for PUSCH transmission on LAA SCell
  - **The reference scheduled burst** is the most recent set of **contiguous** (i.e. without any gap in between) scheduled UL subframe(s) for the UE that is expected to start after a category 4 LBT and is expected to end at least 4 subframes earlier than the subframe in which the following contention window size adjustment is transmitted
  - **The reference subframe** is the first subframe in the reference scheduled burst where the eNB successfully **decodes** at least one transport block from the UE.
  - The position of the reference subframe within the reference scheduled burst is signaled to the UE in the UL grant in which Cat. 4 LBT is signaled as the LBT type to the UE
    - The eNB can also signal that no reference subframe was detected
  - If the UE first transmitted in the reference scheduled burst earlier than the signaled reference subframe, the CWSs for all the priority classes are increased.
  - If the UE first transmitted in the reference scheduled burst later than the signaled reference subframe, the CWSs for all the priority classes are left unchanged.
  - If the UE first transmitted in the reference scheduled burst in the signaled reference subframe, the CWSs for all the priority classes are reset.
  - The CWS is reset to the minimum value if the maximum CWS is used for K consecutive LBT attempts only for the priority class for which maximum CWS is used for K consecutive LBT attempts.
    - K is selected by eNB and RRC configured to the UE from the set of values from (1, …,8).

R1-165716 WF on MCOT Limit Signaling and Modifying LBT Type Ericsson, ZTE, Mediatek, WILUS

R1-164071 Discussion on the applications of LBT options in eLAA Huawei, HiSilicon
R1-164072 UL category 4 LBT with eNB assistance Huawei, HiSilicon
R1-164132 Remaining details for UL LBT Intel Corporation
R1-164200 UL channel access for Rel-14 eLAA CATT
R1-164318 Considerations for UL LBT Sequans Communications
R1-164415 UL channel access for eLAA Qualcomm Incorporated
R1-164416 Discussion on ED threshold for UEs in eLAA Qualcomm Incorporated
R1-164502 LBT schemes in LAA UL LG Electronics
R1-164503 Further details on channel access in LAA UL LG Electronics
R1-164504 Impact of UE-to-UE interference on LAA performance LG Electronics
R1-164505 Initial signal in LAA uplink LG Electronics
R1-164601 Frame design and signalling for LAA UL based on FS3 ZTE
R1-164603 Discussion on the UL LBT for LAA ZTE
R1-164604 LBT for Frequency and reuse and Multiplexing in Uplink ZTE
R1-164605 WF on UE initiated TxOP/MCOT shared by the eNB ZTE
R1-164648 LBT mechanism for LAA uplink Lenovo (Beijing) Ltd
R1-164720 Channel Access Scheme for UE multiplexing Kyocera Corporation
R1-164750 Discussion of LAA-LAA coexistence Samsung
R1-164751 Discussion on UL LBT alignment Samsung
R1-164752 Discussion on shared MCOT and LBT procedure Samsung
R1-164753 Remaining issues on Cat 4 LBT for eLAA Samsung
R1-164815 On the need of reservation signal Huawei, HiSilicon
R1-164827 Other issues related to LBT for eLAA Huawei, HiSilicon
R1-164905 Dynamic carrier selection for LAA HTC
R1-164995 Methods of UL LAA channel access Sharp
R1-165032 Error Cases due to Failed Clear Channel Assessment for UL Transmissions Panasonic
R1-165071 Defer period for UL LBT Intel Corporation
R1-165120 eLAA Uplink channel access Mediatek
R1-165140 PUSCH DTX Detection for LAA UL Nokia, Alcatel-Lucent Shanghai Bell
R1-165153 Summary of Email Discussion [84b-06] on UL Channel Access Schemes Ericsson
R1-165154 On Channel Access Procedures for PRACH and SRS Ericsson
R1-165155 On Channel Access Procedures for Transmissions with Only UL Grants Ericsson
R1-165157 On UL Channel Access Procedures Ericsson

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R1-165158 On Performance of UL Channel Access Procedures Ericsson
R1-165159 On Signaling of UL Channel Access Parameters Ericsson
R1-165190 Discussion on channel access framework for eLAA UL NTT DOCOMO, INC.
R1-165235 Uplink Channel Access Mechanisms in eLAA III
R1-165250 On channel access mechanism for eLAA ETRI
R1-165252 Consideration on UL LBT Type Switching for eLAA WILUS Inc.
R1-165253 CWS adjustment for UL PUSCH in eLAA WILUS Inc.
R1-165318 Discussion on LAA paused COT and UL traffic multiplexing BROADCOM LIMITED

6.2.1.6 Others

R1-164106 Discussion on synchronous and asynchronous HARQ method for eLAA Huawei, HiSilicon
R1-164506 Power control in LAA uplink LG Electronics
R1-164921 On the Support for UL Operation in FS3 and C-PDCCH Nokia, Alcatel-Lucent Shanghai Bell

6.2.2 Support for V2V services based on LTE sidelink

WID in RP-160649
R1-165935 Chairman's Notes of Agenda Item 6.2.2 on V2V Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

Email approval to RAN2/4 to tell this week agreements and WA until 2nd June – Hanbyul (LGE)

Editors will submit draft CRs (201, 211, 212, 213, 214) until 18th August based on the following list
Rapporteur needs to submit agreement and WA lists until 30th June

R1-165608 Summary of Tuesday offline discussions on V2V LG Electronics

Agreement:

- For PSSCH resource (re)selection when all the PSCCH/PSSCH transmissions have the same priority (FFS whether the initial resource selection needs to be designed differently from the procedure below)
  - Step 1: All the resources are considered available.
  - Step 2: UE excludes resources at least based on SA decoding and additional conditions. Down select one between the following options.
    - Option 2-1: A resource is excluded if it is indicated or reserved by a decoded SA and the received DM RS power in the associated data resource is above a threshold.
    - Option 2-2: A resource is excluded if it is indicated or reserved by a decoded SA and the energy in the associated data resource estimated from the measurement in the SA resource is above a threshold. Additional estimation of energy caused by in-band emission is not precluded.
      - FFS the estimation of the energy in the associated data resource.
      - Measuring energy of SA transmitted from a particular UE may not be accurate enough.
    - The precise definition of "if it is indicated or reserved by a decoded SA" to be discussed later.
    - FFS the details of the thresholds above
  - Step 3: UE selects its transmission resource from the resources not excluded by (Down select one among the following options)
    - Option 3-1:
      - Step 3-1: UE measures and ranks the remaining PSSCH resources based on total received energy and selects a subset
      - Step 3-2: UE compares the energy on the currently selected resource with the energy of the resources the subset. If the energy of the current resource is a threshold above the energy of all the resources in the subset, then UE selects one among the subset of resources.
      - A semi-persistent period before reselection is triggered, UE transmits PSSCH on another resource in the subset identified in step 3-1 and measures the energy of the currently selected resource for step 3-2.
        - Step 3-3: UE randomly selects one resource from the subset
    - Option 3-2:
      - Step 3-1: UE measures and ranks the remaining PSSCH resources based on total received energy and selects a subset
      - Step 3-2: UE randomly selects one resource from the subset
    - Option 3-3:
      - Step 3-1: UE measures and ranks the remaining PSSCH resources based on total received energy and selects a subset
      - Step 3-2: UE selects the resource that minimizes the frequency resource fragmentation from the subset.
    - Option 3-4:
      - Step 3-1: UE measures RX power of PSSCH resource indicated in the decoded SA, sum them as the total RX power

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of a subframe, and sorts the subframes according to the total RX power.
- Step 3-2: A set of available subframes consists of X subframes with the highest total RX power and Y subframes of the lowest total RX power. UE randomly selects transmission subframe(s) from this set.
- Step 3-3: UE randomly selects frequency from transmission subframe(s).
- FFS how to select resources for a wideband transmission based on the energy/power measurement above.

Agreements:

- Reselection is triggered if any of the following conditions are met
  - A counter meets an expiration condition
    - The counter decrements
    - Working assumption: every TB transmission (can be revisited if a problem is identified with TBs other than every 100 ms)
    - The counter is reset to a value when reselection is triggered for all the semi-persistently selected resources.
      - The value is uniformly randomly selected within a range (which is independent of the TB arrivals) between 5 and 15
  - UE identifies that the TB does not fit within the current resource allocation using the maximum allowed MCS,
  - FFS other triggers that may be defined by RAN2,

R1-165898 Summary of Thursday offline discussions on V2V LG

Agreement:

- For all the PSCCH/PSSCH/SLSS/PSBCH transmissions for V2V in all the resource allocation modes, $N_{TA,SL} = 0$
- FFS in RAN1 on the receiver UE assumption on the reception timing, e.g., whether it can assume that all the transmissions in a single subframe use the same synchronization reference.

R1-165991 Summary of Friday offline discussions on V2V LGE

6.2.2.1 Enhancement to sidelink physical layer structure

R1-165072 Enhancements of sidelink physical layer structure for PC5 V2V communication Intel Corporation
R1-165277 L1 Format for V2V Transmissions using Sidelink Ericsson

6.2.2.1.1 DM-RS for PSCCH and PSSCH

R1-164094 DMRS for PSCCH and PSSCH Huawei, HiSilicon
R1-165535 DMRS enhancement in PC5-based V2V CATT
R1-164201 DMRS enhancement in PC5-based V2V CATT
R1-164134 On DMRS physical structure enhancements for PSCCH and PSSCH Intel Corporation

R1-165255 Construction of DMRS sequences Ericsson

R1-164417 DM-RS Enhancements for V2V PSCCH and PSSCH Qualcomm Incorporated
R1-164507 Discussion on DMRS for PSCCH and PSSCH LG Electronics
R1-164754 DMRS configuration for PSSCH and PSCCH Samsung
R1-164902 Link performance of DMRS Enhancement for PSCCH and PSSCH Beijing Xinwei Telecom Techn.
R1-164932 Enhancement to sidelink physical layer structure in supper higfh Doppler case for V2V ITRI
R1-164949 DMRS Enhancements for PSSCH and PSCCH ZTE
R1-165041 Evaluations of DMRS Enhancement for PSCCH and PSSCH Nokia, Alcatel-Lucent Shanghai Bell
R1-165289 link level performance of DM RS for V2V CATR

R1-165658 WF on L1 Format for V2V Communication Intel, ITRI

Agreement:

- Confirm the working assumption that legacy PUSCH RS is used for PSCCH and PSSCH in the four RS symbols.

Agreement:

- Alt 1 + Adapt MCS, the number of RBs, and number of transmission subframes depending on the UE absolute speed and UE synchronization source (e.g. GNSS or eNB)
  - Options for details of PSCCH
    - Working assumption which will be automatically confirmed if no problem is identified during this week
      - DMRS within a TTI for a transmission by a UE are not identical

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- No blind detection of DMRS is introduced
- Details FFS

- Working assumption: 2 consecutive PRB pairs in a subframe are used for each PSCCH if the number of SA bits is less than 64 including CRC. The exact size of SA is FFS including the CRC size and could be larger than 64 bits.
- Options for details of PSSCH
  - Network configuration or preconfiguration can be used to associate the ranges of MCS, RB number for PSSCH, number of retransmission with the condition of the UE absolute speed. Different (pre)configuration and threshold is given for the different type (e.g., eNB, GNSS, UE) of the transmission synchronization reference.
  - RAN1 will study the proper range of these parameters.

R1-165676 WF on PSSCH DMRS and SA ID LG Electronics, ZTE, Qualcomm, Nokia, ASB, Samsung, CATT

R1-165592 WF on Supporting 500kmph for SA Qualcomm, LGE
R1-165604 WF on Multi-Cluster PSSCH Transmissions Qualcomm, Samsung

6.2.2.1.2 DM-RS for PSBCH

R1-165307 DMRS design for PSBCH Samsung
R1-164095 DMRS for PSBCH Huawei, HiSilicon

R1-164135 On DMRS physical structure enhancements for PSBCH Intel Corporation
R1-164202 DMRS enhancement for PSBCH CATT
R1-164320 Discussion on DM-RS for PSBCH for sidelink-based V2V communication Fujitsu
R1-164418 DM-RS Enhancements for V2V PSBCH Qualcomm Incorporated
R1-164508 Discussion on DMRS for PSBCH LG Electronics
R1-164755 DMRS design for PSBCH Samsung
R1-164958 DMRS for PSBCH ZTE

R1-165677 WF on PSBCH DMRS LG Electronics, ZTE, Qualcomm, ITL, KRRI

Agreements:

- For PSBCH DM RS symbol location, Option 3 (i.e., symbol #4, #6, #9 for normal CP) is supported.
- Working assumption: PSBCH content size is the same as Rel-12.
- Working assumption: V2V SLSS/PSBCH periodicity is 200 ms.
- If it is agreed that SLSS/PSBCH is used for the purpose of detecting LTE ITS transmissions, this working assumption needs to be revisited.
- Rel-13 D2D synchronization resource configuration principle is reused.

6.2.2.1.3 Others

Including adaptation of MCS, the number of RBs, and number of transmission subframes depending on the UE absolute speed and UE synchronization source (e.g, GNSS or eNB)

R1-164509 Discussion on adaptation of MCS depending on UE speed LG Electronics
R1-165268 Radio measurements for congestion control for V2X Ericsson
Moved from 6.2.2.2.4

R1-164756 Supporting 500 km/h relative speed requirement for V2V Samsung
R1-164864 Discussion on inband emission suppression for V2V communications Huawei, HiSilicon

R1-165678 WF on transmission parameter adaptation LG Electronics, Ericsson, ITL, KRRI, Docomo

6.2.2.2 Sensing with semi-persistent transmission in UE autonomous resource selection mode

R1-165266 Sensing and autonomous resource selection Ericsson

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R1-165073 Discussion on sensing aspects to support V2V communication with different traffic periodicity Intel Corporation

R1-165957 WF on semi-persistent transmission for mode 2 E///

6.2.2.2.1 Details of using SA decoding and energy measurement for sensing

R1-164136 Utilization of PSCCH decoding and energy measurements for sensing based V2V communication Intel Corporation
R1-164203 Discussion on sensing mechanism in PC5-based V2V CATT
R1-164419 Details of sensing for V2V Qualcomm Incorporated
Section 3 only
R1-164467 UE sensing based congestion control for mode-2 Guangdong OPPO Mobile Telecom.
R1-164510 Discussion on details of sensing operation for PC5 based V2V LG Electronics
R1-164757 Sensing procedure for UE autonomous resource selection Samsung
R1-164758 RSRP measurement on decoded SA for sensing Samsung
R1-164959 SA decoding and energy measurement ZTE
R1-164984 Discussion on SA Decoding and Energy Measurement Beijing Xinwei Telecom Techn.
R1-165039 On sensing with SA decoding and energy measurement for V2V INTERDIGITAL COMMUNICATIONS
R1-165042 On sensing with semi-persistent transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-165191 Discussion on SA decoding and energy measurement for sensing NTT DOCOMO, INC.
R1-165306 Discussion on SA decoding and energy measurement for sensing Sony

R1-165679 WF on sub-channelization LG Electronics, Ericsson, CATT, Intel
Also supported by Lenovo
Proposed agreements:

- Sub-channelization is supported for PSSCH.
  - A sub-channel consists of a group of RBs in a same subframe.
  - The sub-channel size in a resource pool can be configured by eNB or preconfigured.
    - Candidate sub-channel sizes are FFS.
  - Sub-channel size is the same in a resource pool.
  - Different sub-channels have disjoint group of adjacent RBs.
    - FFS whether different formation of sub-channels is needed if multi-cluster transmission is supported.
- Energy sensing granularity of PSSCH is based on the size of sub-channel.
- The UE always (re)selects an integer number of subchannels for transmission.
- The UE always transmits on an integer number of subchannels.

Continue discussion.

R1-165499 Updated WF on sub-channelisation LG

6.2.2.2.2 Details of the transmitter UE behaviour in resource selection/reselection

Including the time duration in which UE performs sensing, the transmission timing of SA and the associated data, and the indication of the intention to reuse the frequency resource for another TB

R1-164137 Transmitter behavior for sidelink resource re-selection Intel Corporation
R1-165192 Transmitter UE behaviour for sensing-based resource allocation NTT DOCOMO, INC.

R1-164102 Discussion on sensing details for measurement and reservation Huawei, HiSilicon
R1-164204 Discussion on resource selection mechanism in PC5-based V2V CATT
R1-164205 Discussion on time duration of sensing in PC5-based V2V CATT
R1-164206 Further consideration on UE autonomous resource allocation in PC5-based V2V CATT
R1-164419 Details of sensing for V2V Qualcomm Incorporated
R1-164468 Discussion on the SPS configuration for mode-2 Guangdong OPPO Mobile Telecom.
R1-164473 Schedule Assignment for SPS NEC
R1-164511 Discussion on details of resource selection for PC5 based V2V LG Electronics
R1-164645 UE autonomous resource selection for semi-persistent transmission Lenovo (Beijing) Ltd
R1-164670 Discussion on the transmitter UE behavior in resource selection/reselection Sony
R1-164759 UE operation after sensing in UE autonomous resource selection Samsung
R1-164855 Power control for V2V Huawei, HiSilicon
R1-164933 Discussion on explicit and implicit approaches for enhanced random resource selection ITRI
R1-164960 Transmitter UE behavior in V2V ZTE
R1-164961 Geo Based Resource Allocation for V2V ZTE

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R1-165043 On resource selection with sensing Nokia, Alcatel-Lucent Shanghai Bell
R1-165240 Considerations on UE autonomous resource selection for V2V Innovative Technology Lab Co.
R1-165244 Adaptation of MCS, RB allocation, and number of retransmissions Ericsson
R1-165271 How Should PC5 Autonomous Resource Allocation be Specified? Ericsson
R1-165276 Discussion on V2X PC5 Scheduling, Resource Pools and Resource Patterns Ericsson
R1-165315 Sensing and SPS for UE Autonomous Mode PANASONIC

R1-165698 Way forward on timeline for sensing based UE autonomous resource selection NTT DOCOMO, NEC, Samsung
Also supported by Huawei, HiSilicon, Intel

R1-165740 WF on semi-persistent transmission for mode 2 Ericsson, Qualcomm

Agreement:

- The values of a and b are fixed
  - b > 0
  - Confirm the working assumption "The values a and b are common for V2V UEs"
    - a = 1000 + b
  - All the decoded SA transmissions in TTI [n-a, n-b) are taken into account.
  - A decoded SA which is associated with data transmissions in data resource(s) at any TTI [n-a, n-b) and transmitted earlier than TTI n-a is taken into account.
- FFS: If UE skips sensing on sub-frame m, for e.g.: due to its own transmission in sub-frame m, it excludes resources in subframes at m+100*k in the resource (re)selection (if triggered), until it is able to perform sensing in those sub-frames.
- FFS on the following:
  - c > 0
  - c, d <= 100
  - FFS how to further restrict the selection of c and d, e.g., to fulfill the latency requirement
- FFS on the details of e, e.g., the receiver UE assumption on the transmitter UE behavior in reusing the same resource.

Email approval about above FFSs until 9th June – Hanbyul (LGE)
R1-165909
R1-165904 WF on resource usage indication LG

6.2.2.2.3 Details of triggering resource reselection

R1-164096 Resource (re)selection triggering mechanisms Huawei, HiSilicon
R1-164138 Discussion on resource reselection triggers for V2V communication Intel Corporation
R1-164474 Triggering resource reselection based on collision detection NEC
R1-164512 Discussion on details of resource reselection for PC5 based V2V LG Electronics
R1-164760 Triggering conditions for resource reselection Samsung
R1-164962 Discussion on V2V resource reselection ZTE
R1-165263 Resource reselection Ericsson

R1-165692 WF on UE measurement and reporting Huawei

Agreements:
Send LS to RAN2 to ask them to define the following UE behavior for resource reselection triggering with the following additional agreements:

- eNB implicitly triggers reselection whenever the resource pool configuration is changed
  - Dedicated signalling is used for RRC_Connected UEs and broadcast signalling is used for RRC_Idle UEs
  - FFS whether some information needs to reported from UE to eNB

6.2.2.2.4 Priority handling

R1-164207 Considerations on V2V priority handling CATT
R1-164420 Priority handling for autonomous resource selection Qualcomm Incorporated
R1-164901 Discussion on V2V Priority Handling Beijing Xinwei Telecom Techn.

R1-165561 Way Forward on priority information in SCI Huawei, HiSilicon, Intel, Ericsson, Sharp, LG Electronics, NTT DoCoMo, OPPO , ITRI, Kyocera, Nokia, ASB, Potevio
Also suppoted by Sony, ZTE, III, CATT

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Agreements:

- Working assumption: PPPP is used to identify which PDCP PDU has which priority level. RAN1 will not use any additional notion of priority.
- Send LS to RAN2 (CC: SA2) to confirm this working assumption. (Shailesh – Qualcomm)

R1-165750 [DRAFT] LS on Priority for V2V Qualcomm
Agreed in R1-165814 with adding SA2 in "CC" and reflecting the changes in the working assumption.

Working assumption:

- SCI explicitly includes priority information.
  - FFS how this priority information is exactly transmitted in SCI.
  - Priority information in a decoded SCI is used in resource (re)selection.
  - Priority information in a decoded SCI is not used as a condition to trigger resource reselection
  - Priority information in a decoded SCI is not used as a condition to drop transmission.
- A measurement metric is specified to reflect the congestion level of a PC5 carrier, e.g., similarly to the channel busy ratio defined in ETSI.
  - This measurement is available to higher layers in the UE.
  - FFS whether the measurement can be reported to eNB.
  - FFS the details of the measurement and the UE behavior, for example:
  - The principle to drop PC5 transmissions as a function of this measurement and priority is supported.
  - The radio adjusts radio parameters (max tx power, nr of retx restriction, MCS range restriction, nr of PRBs restriction) as a function of priority and this measurement.
  - Packets with different priorities are transmitted on the same resource pool
- Revoke the existing working assumption on the resource reselection triggering condition: UE detects resource allocation (including the indication of the intention of reusing the frequency resource as per the existing agreement) of another UE which potentially overlaps with its current resource allocation (including the indication of the intention of reusing the frequency resource as per the existing agreement) and the detected situation meets an FFS condition
  - different conditions for different priorities are not precluded (if any relevant case happens in priority handling from RAN1 point of view).
  - Note that applies to resource reselection triggering only.

R1-164104 Discussion on the priority handling Huawei, HiSilicon
R1-164139 Design options to support priority for V2V communication Intel Corporation
R1-164322 Discussion on resource allocation for V2V based on LTE sidelink Fujitsu
R1-164513 Discussion on details of priority handling for PC5 based V2V LG Electronics
R1-164671 Discussion on the priority handling for UE-autonomous resource (re)selection Sony
R1-164761 Priority handling for UE autonomous resource selection Samsung
R1-165040 On priority handling for V2V INTERDIGITAL COMMUNICATIONS
R1-165044 Priority considerations for autonomous V2V communication Nokia, Alcatel-Lucent Shanghai Bell
R1-165260 Priority handling for V2V over PC5 Ericsson

R1-165952 WF on priority handling for V2V Huawei et al

6.2.2.2.5 Others

R1-164466 Discussion on the mode-2 resource allocation for V2V Guangdong OPPO Mobile Telecom.

6.2.2.3 Semi-persistent scheduling for sidelink resource in eNB scheduling mode

R1-164818 SPS enhancement for V2V Huawei, HiSilicon
R1-165309 Details on PC5 SPS enhancement PANASONIC

Agreements:

- Support cross carrier scheduling for sidelink SPS and dynamic scheduling for V2V with mode-1
- PC5-based V2V design will support the multiple-operator scenario but not be optimized for it.
- Details FFS, e.g.,
  - How to handle timing difference between eNB timing and PC5 timing, when it exists
  - PC5 resource partitioning among multiple operators
  - Resource coordination across operators is out of 3GPP scope.

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6.2.2.3.1 Details of (E)PDCCH used for SPS

Including details of resource indication and how to trigger/release different SPS configurations

R1-164878	Discussion on SPS configurations	CMCC
R1-164963	Trigger and release of V2V SPS	ZTE
R1-164421	eNodeB signaling for SPS resource allocation	Qualcomm Incorporated
R1-164514	Discussion on details of (E)PDCCH used for sidelink SPS	LG Electronics
R1-164762	Multiple SPS configuration support for SL	Samsung
R1-164906	Signaling design to support SPS activation/release in V2V	Panasonic
R1-165193	(E)PDCCH for sidelink SPS configuration switching	NTT DOCOMO, INC.
R1-165246	Contents of Downlink Control Information for V2V over PC5	Ericsson
R1-165699	WF on (E)PDCCH used for multiple SPS configurations	NTT DOCOMO, …
R1-165728	WF on PDCCH	LGE, …
R1-165907	WF on cross carrier scheduling in PC5-based V2V	CMCC

6.2.2.3.2 Details of UE reporting

Including details of UE indication to eNB on the transmission intention and the need of eNB acknowledgement

R1-164321	Discussion on the resource allocation enhancement for sidelink-based V2V communication	Fujitsu
R1-164422	UE reporting for eNodeB resource allocation	Qualcomm Incorporated
R1-164475	Reporting of radio-level measurements of sidelink	NEC
R1-164515	Discussion on details of UE reporting	LG Electronics
R1-164763	UE reporting procedure for SL SPS transmissions	Samsung
R1-164964	Discussion on UE reporting	ZTE
R1-165258	Geo-Info reporting to eNB	Ericsson
R1-165272	Mode-1 SPS for V2V over PC5	Ericsson

6.2.2.3.3 Others

Including priority handling

6.2.2.4 Details of resource pool design

Including how to configure SA and data resources FDMed from system perspective and how a data pool is associated with an SA pool

R1-164056	Resource pool design and multiplexing of SA and its associated data	Huawei, HiSilicon
R1-164140	Details of resource pool design for sidelink V2V communication	Intel Corporation
R1-164423	Resource pool design for V2V	Qualcomm Incorporated
R1-164424	MPR for same subframe control and data transmission for V2V	Qualcomm Incorporated
R1-164208	Resource pool enhancement in PC5-based V2V	CATT
R1-164323	Discussion on Resource Pool for PC5 based V2V	Fujitsu
R1-164476	Resource pool design for collision detection and handling	NEC
R1-164516	Discussion on remaining issues on resource pool design for PC5 based V2V	LG Electronics
R1-164646	Resource pool for V2V	Lenovo (Beijing) Ltd
R1-164764	Details on resource pool design	Samsung
R1-164903	Enhancement on V2V geo-based resource pool	Beijing Xinwei Telecom Techn.
R1-164965	Discussion on resource pools and SA resource pattern	ZTE
R1-165066	Details of V2V resource pool design	Potevio
R1-165195	Discussion on resource pool for PC5 based V2V communications	NTT DOCOMO, INC.
R1-165273	Subbands and measurements for sensing for V2V over PC5	Ericsson
R1-165591	WF on Same Subframe SA and Data transmission	Qualcomm, Ericsson, LGE

Agreements:

- Allow resource pool definition where SA and associated Data transmitted on the same subframe are always adjacent in frequency
  - All the PRBs used for the SA and associated data transmissions should be contiguous in frequency.
  - Details FFS

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- For a SA and associated data resource pool it should be (pre)configured whether the SA and associated data transmission by all the UEs using this pool either occur on the same subframe in an adjacent manner, or occur on different subframes, (FFS or occur on the same subframe in a potentially non-adjacent manner).
  - If the FFS part is not supported, this reverts the existing agreement "When SA and the associated data are transmitted in the same TTI, they can be transmitted in non-adjacent RBs."
  - Strive for not increasing the number of SA blind decoding to enable this.

R1-165755 WF on resource pool configuration Huawei, HiSilicon, ZTE, NTT DoCoMo

6.2.2.5 Scheduling assignment

Including the content of SCI

R1-164103 Discussion on SCI contents for V2V Huawei, HiSilicon
R1-164141 Scheduling assignment for sidelink V2V communication Intel Corporation
R1-164209 Discussion on contents of scheduling assignment CATT
R1-164425 Scheduling Assignments for V2V Qualcomm Incorporated
R1-164517 Discussion on details of scheduling assignment for PC5 based V2V LG Electronics
R1-164636 SA contents for V2V Lenovo (Beijing) Ltd
R1-164765 Discussion on SCI contents Samsung
R1-164817 Variable number of transmissions for V2V Huawei, HiSilicon
R1-164907 Repetition and relationship between SA and associated data Panasonic
R1-164966 Discussion on SA content ZTE
R1-165046 On SCI Contents Nokia, Alcatel-Lucent Shanghai Bell
R1-165067 Contents of SCI for V2V communication Potevio
R1-165196 Discussion on enahancement of scheduling assignement in V2V communications NTT DOCOMO, INC.
R1-165262 Relation between SA and data for V2V over PC5 Ericsson
R1-165264 Contents of PSCCH for V2V over PC5 Ericsson

6.2.2.6 Details of coexistence of PC5-based V2V operation and legacy Uu operation

R1-164967 Coexistence of PC5-based V2V operation and legacy Uu operation ZTE
R1-165259 On the Need for V2V Gaps Ericsson

6.2.2.6.1 Details of prioritizing sidelink transmissions over UL transmissions

R1-164766 Prioritization of sidelink transmissions over Uplink transmissions Samsung
R1-165197 Details of prioritizing sidelink transmissions over UL transmissions NTT DOCOMO, INC.

R1-164112 Coexistence of cellular and V2V services on the same carrier Huawei, HiSilicon
R1-164518 Discussion on details of prioritizing sidelink transmissions over UL transmissions LG Electronics

R1-165733 WF on V2V Tx gap NTT Docomo

6.2.2.6.2 Others

Including reusing sidelink open loop power control and the need of RSRP-based resource selection

R1-164392 Discussion on intra-UE coexistence between 5.9GHz PC5 chain and 2GHz Uu chain for V-UE CATT
R1-164519 Discussion on remaining issues on coexistence of PC5-based V2V and legacy Uu LG Electronics

6.2.2.7 Enhancement to sidelink synchronization procedure

Low priority is given to enhancements to Rel-12/13 SLSS-based synchronization.

R1-164113 Timing alignment of different synchronization sources for V2V Huawei, HiSilicon
R1-164426 Synchronization Procedure for V2V Qualcomm Incorporated
R1-165317 Distributed Synchronization Procedure for V2X over PC5 Ericsson

R1-165743 WF on differentiating the GNSS timing and eNB timing Huawei
R1-165745 WF on timing offset between eNB timing and PC5 based V2V Huawei
R1-165744 WF on sync priority for OOC Huawei

Agreements:

- Rel-12 DFN definition is reused.
  - When GNSS is the synchronization reference, DFN is derived from GNSS.
- Details are up to RAN2.
  - For the other cases, DFN is derived according to Rel-12 behavior.

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Working assumption:

Working assumption for the V2V PC5 SLSS:

- At least one value is reserved for SLSS ID used for SLSS transmissions from UEs having GNSS as the synchronization reference.
- FFS whether multiple values need to be reserved.
- The reserved value(s) of the SLSS IDs is(are) pre-defined.
- If it is agreed that SLSS/PSBCH is used for the purpose of detecting LTE ITS transmissions, this working assumption needs to be revisited.

Conclusion:

- Companies are encouraged to consider whether having GNSS as the highest sync priority for OOC UEs have significant impact on in-coverage UE operations.

Working assumption:

- SSSS for V2V uses sequences of subframe-5 SSS
  - If it is agreed that SLSS/PSBCH is used for the purpose of detecting LTE ITS transmissions, this working assumption may need to be revisited.

6.2.2.7.1 Priority order of synchronization references

R1-164101 The remaining issues for V2V PC5 synchronization priority Huawei, HiSilicon
R1-164968 Priority order of synchronization references ZTE

R1-164105 Sidelink synchronization enhancement in V2V communication Huawei, HiSilicon
R1-164210 Synchronization enhancements in PC5-based V2V CATT
R1-164469 Discussion on the GNSS based synchronization Guangdong OPPO Mobile Telecom.
R1-164520 Discussion on details of synchronization enhancements LG Electronics
R1-164767 Priority order for synchronization references Samsung
R1-164934 Discussion multiple synchronization references on sidelink synchronization procedure for PC5-basde V2V communication ITRI
R1-165045 Prioritization of sidelink synchronization sources Nokia, Alcatel-Lucent Shanghai Bell
R1-165074 Priority order of synchronization references for sidelink V2V communication Intel Corporation
R1-165198 SLSS enhancements for GNSS based synchronization NTT DOCOMO, INC.
R1-165241 Considerations on priority order of synchronization references for V2V Innovative Technology Lab Co.
R1-165308 V2V synchronization remaining issues PANASONIC

6.2.2.7.2 Others

Including how sidelink TTI/subframe number and frame number are derived

R1-164477 Determining the radio frame and subframe for V2X synchronisation signals NEC
R1-164521 Discussion on sidelink subframe timing and number determination LG Electronics
R1-164768 Differentiation on synchronization references Samsung

R1-164211 Discussion on synchronization issues of physical design CATT
R1-164212 Discussion on PSBCH issues CATT
R1-164213 Timing alignment for V2V CATT
R1-164866 SLSS and PSBCH design for V2V PC5 Huawei, HiSilicon
R1-164969 Enhancement to the sidelink synchronization ZTE
R1-164996 Remaining Issue Discussions on V2X Synchronization Sharp

R1-165680 WF on timing LGE
R1-165749 WF on V2V SLSS/PSBCH Huawei
R1-165908 WF on V2V and D2D SLS differentiation Samsung

6.2.2.8 Others

R1-164769 Transmit power control for V2V Samsung
R1-164908 MCS report in mode 1 resource allocation Panasonic
R1-165245 Observations on CAM Message Periodicity and Payload Ericsson

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6.2.3 Enhancements on Full-Dimension (FD) MIMO for LTE

WID in RP-160623

R1-165936 Chairman's Notes of Agenda Item 6.2.3 on FDMIMO Session Chairman (Qualcomm Inc., Nokia, Samsung)
Contents incorporated below
Endorsed with following updates

R1-165447 Proposed work plan for RAN1#85 Samsung, Nokia, CATT

Conclusion:
- RAN1 to aim to conclude on the three "*evaluate and, if needed, specify*" items
- Decide for each of the three items:
  - whether to specify or not to specify
  - if RAN1 decides to specify, decide the scope of specification work
- Based on the decisions, recommend to refine scoping of the WI to RAN plenary

6.2.3.1 Reference Signals

6.2.3.1.1 Non-precoded CSI-RS

For {20, 24, 28, 32} ports with mechanism for overhead reduction

R1-164142 Discussion on CSI-RS for Class A FD-MIMO with overhead reduction Intel Corporation
R1-164214 CSI-RS enhancement for {20,24,28,32} ports CATT
R1-164771 Discussions on CSI-RS enhancements for Class A CSI reporting Samsung
R1-165047 On non-precoded CSI-RS overhead reduction InterDigital
R1-165199 Discussion on CSI-RS Port Extension NTT DOCOMO, INC.

R1-165593 WF on enhancements for non-precoded CSI-RS LG Electronics, Samsung, NEC
R1-165589 WF on NP CSI-RS Aggregation ZTE, Qualcomm, Beijing Xinwei Tech.

Agreement:
- For {20, 24, 28, 32} ports, a CSI-RS resource for class A CSI reporting is aggregated as follows (where M_k is the # of CSI-RS ports in a CSI-RS configuration)
  - For {24, 32} ports, $\sum_k M_k \in \{24, 32\}$, M_k is either 4 or 8, where the same $M_k = M$ used for all k
    - Possible down-selection till RAN1#86 regarding M_k=4 vs. 8
  - For {20, 28} ports, FFS till RAN1#86 (including possible down-selection)
    - Alt 1: $\sum_k M_k \in \{20, 28\}$, M_k is either 4 or 8, where the same $M_k = M$ used for all k
      - Possible down-selection till RAN1#86 regarding M_k=4 vs. 8.
      - If M_k=8 is supported, FFS the details
    - Alt 2: $\sum_k M_k \in \{20, 28\}$, $M_k \in \{4, 8\}$, where M_k may be different for different k
  - FFS port numbering
  - FFS N vs. M

R1-165613 WF on non-precoded CSI-RS Samsung, LGE, NEC
Proposal:
- For {20, 24, 28, 32} ports, CSI-RS RE density can be lower than 1RE/RB/port
  - The chosen scheme(s) will be down-selected/merged among following alternatives
    - FDM
    - Partial port

Continue discussion offline till RAN1#86

R1-165616 Way-forward on CDM-8 for Non-Precoded CSI-RS CATT, Intel, NEC
Proposal:
- At least OCC- 8 is supported for more than 16 ports non-precoded CSI-RS
  - other OCC value not precluded

Conclusion:

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- Further discussion till RAN1#86, especially regarding evaluating different alternatives, e.g., using OCC 2/4/8, high reuse of CSI-RS, etc.

R1-164215	Discussion on CSI-RS overhead reduction	CATT
R1-164216	Discussion on backward compatiblity of Rel.12 and Rel.13 CSI-RS	CATT
R1-164308	Views on non-precoded CSI-RS design for eFD-MIMO	ZTE
R1-164309	Aperiodic CSI-RS for non-precoded CSI-RS	ZTE
R1-164324	Discussion on non-precoded CSI-RS	Fujitsu
R1-164335	CSI-RS Design Supporting up to 32 Antenna Ports	Nokia, Alcatel-Lucent Shanghai Bell
R1-164427	Non-precoded CSI-RS design for up to 32 ports	Qualcomm Incorporated
R1-164481	Design for Non-precoded CSI-RS for overhead reduction	NEC
R1-164483	Discussion on CSI-RS with CDM8	NEC
R1-164522	Discussion on CSI-RS designs for eFD-MIMO	LG Electronics
R1-164770	Port-based CSI-RS overhead reduction	Samsung
R1-164772	Evaluation results on CSI-RS RE densities	Samsung
R1-164822	CSI-RS pattern design for up to 32 ports	Huawei, HiSilicon
R1-164879	Discussion on non-precoded CSI-RS enhancement	CMCC
R1-164896	Discussion on Non-precoded CSI-RS Design for eFD-MIMO	Beijing Xinwei Telecom Techn.
R1-165094	CSI-RS Design for Class A eFD-MIMO	Ericsson
R1-165397	Discussion on Non-precodes CSI-RS for eFD-MIMO	Beijing Xinwei Telecom Techn.

6.2.3.1.2 Beamformed CSI-RS

More efficient resource utilization for UE-specific BF CSI-RS, including aperiodic CSI-RS

R1-164428	Enhancements on Beamformed CSI-RS for eFD-MIMO	Qualcomm Incorporated
R1-164523	Beamformed CSI-RS enhancements including aperiodic CSI-RS	LG Electronics
R1-164773	On aperiodic CSI-RS design	Samsung
R1-164845	PDSCH rate matching enhancement for aperiodic NZP and ZP CSI-RS	Huawei, HiSilicon
R1-165406	Dynamic CSI-RS Design and Overhead Reduction	Ericsson

Revision of R1-165095

R1-165585	WF on beamformed CSI-RS enhancements	LG Electronics, Samsung, Qualcomm

Agreement:

- Scheme 1: Aperiodic NZP CSI-RS resource is supported in Rel-14 for Class B eMIMO-Type, where
  - Only PUSCH based A-CSI reporting is supported.
  - A new aperiodic CSI-RS resource allocation/configuration is defined
    - Without *Subframe_config*
  - Aperiodic CSI-RS transmission instance is indicated by UL-related DCI transmitted on a control channel with a CSI request field:
    - Aperiodic CSI-RS transmission is in the same DL subframe as the associated UL-related DCI
    - FFS whether or not the UE may not assume more than one aperiodic NZP CSI-RS resource. If more than one resource is allowed, FFS the signaling details
    - FFS the number of bits for the CSI request field
    - The control channel can be PDCCH or EPDCCH. FFS whether or not the case of EPDCCH can be precluded or with some restrictions/relaxations
  - FFS whether or not periodic CSI-RS can be additionally configured
- Scheme 2: For Class B eMIMO-Type, the following CSI-RS resource configuration mechanism is supported
  - A UE receives an activation/release trigger containing a choice from multiple higher-layer-configured NZP CSI-RS resources for a given CSI process
    - Each NZP CSI-RS resource can be either periodic or, aperiodic CSI-RS resource (if scheme 1 is supported)
    - Details of the activation/release trigger (including the set of NZP CSI-RS resource configuration parameters) are FFS
  - For an activation trigger received in subframe n, the transmission of the associated NZP CSI-RS resource will start no earlier than subframe n+X where X>0
  - For a release trigger received in subframe n, the transmission of the associated NZP CSI-RS resource will stop after subframe n+Y where Y>0
    - FFS the impact of multi-shot configuration, if supported
  - FFS whether or not there are any significant issues regarding the potential misalignment about activation and/or release between eNB and UE, and if so, how to address them

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- FFS whether or not to further enhance rate matching for PDSCH, particularly whether or not aperiodic NZP CSI-RS will not have impact on PDSCH RE mapping
- FFS the QCL details
- Down-selection between scheme 1 and scheme 2 (if any) to be discussed in RAN1#86

R1-165642 WF on Beamformed CSI-RS Huawei, HiSilicon, CATT

R1-164336 CSI-RS Overhead Reduction for Beamformed CSI-RS Transmission Schemes Nokia, Alcatel-Lucent Shanghai Bell
R1-164143 Discussion on CSI-RS overhead reduction schemes for Class B FD-MIMO Intel Corporation

Conclusion:
- Candidate schemes for CSI-RS overhead reduction for Class B eMIMO-Type (2, 4, and 8 ports):
  - Scheme 1: Configurable CSI-RS frequency-domain density
  - Scheme 2: Localized CSI-RS in frequency domain
  - Scheme 3: Configurable RPF pattern
  - Scheme 4: Frequency domain MR
- Companies are encouraged to study the following issues in the next meeting:
  - Backward compatibility
  - UE implementation restriction (for, e.g. channel estimation)
  - Impact on eNB scheduling
  - Impact on CSI reporting
  - PDSCH rate matching

R1-164217 On aperiodic CSI-RS transmission CATT
R1-164218 Enhancements on beamformed CSI-RS CATT
R1-164310 Enhancements on Beamformed CSI-RS ZTE
R1-164858 Discussion on efficient utilization of BF CSI-RS Huawei, HiSilicon
R1-164930 Discussion on beamformed CSI-RS ITRI
R1-165200 Aperiodic CSI-RS with Semi-static Resource Reservation NTT DOCOMO, INC.

6.2.3.1.3 Uplink DM-RS

Evaluate and, if needed, specify more orthogonal ports with partially overlapping BW allocations

R1-164144 Discussion on UL DMRS Enhancement for FD-MIMO Intel Corporation
R1-164429 Performance evaluation of uplink DMRS enhancements for MU-MIMO Qualcomm Incorporated

R1-164099 Discussion on more orthogonal DMRS ports with partial overlapping Huawei, HiSilicon
R1-164311 Discussion on UL DMRS enhancement for eFD-MIMO ZTE
R1-164337 UL DMRS Enhancement and Evaluations for FD-MIMO Nokia, Alcatel-Lucent Shanghai Bell
R1-164484 Proposals for uplink DM-RS enhancement NEC

R1-164219 Discussion on UL DMRS enhancement CATT
R1-164348 General views on DM-RS enhancements in uplink for FD-MIMO Fiberhome Technologies Group
R1-164524 Uplink DMRS enhancements for eFD-MIMO LG Electronics
R1-164774 Discussion on uplink DMRS for partially overlapping bandwidth allocations Samsung
R1-165096 Discussion on UL DMRS Enhancements Ericsson

6.2.3.2 CSI Reporting

R1-164775 Discussions on periodic CSI reporting for class A in eFD-MIMO Samsung

6.2.3.2.1 Non-precoded CSI-RS codebooks

For newly defined number of ports for NP CSI-RS for a subset of possible port layouts,both 1D and 2D

R1-164857 Discussion on codebook design to support up to 32 ports CSI-RS Huawei, HiSilicon
R1-164430 Non-precoded CSI-RS Codebooks for eFD-MIMO Qualcomm Incorporated
R1-164145 Discussion on Class A codebook extension Intel Corporation
R1-164146 Performance evaluation of Class A codebooks with 32 ports Intel Corporation

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R1-164312 Discussion on rank 1-2 codebook design for eFD-MIMO ZTE
R1-165097 Class A Codebook Design for up to 32 Ports in Rel-14 Ericsson

R1-165594 WF on enhancements on codebook for Rel-14 LG Electronics, ZTE, Qualcomm

Conclusion:
- Class A codebook enhancement:
  - Starting from Rel-13 Class A codebook design structure by enabling different N1 and N2 combinations
- Reduce the number of combinations of codebook parameters (N1, N2, O1, and/or O2)
  - To be concluded in RAN1#86
  - Examples:
    - Down select from 19 (N1,N2) combinations; and/or
    - Reduce the number of (O1,O2) combinations
    - Other possibilities are not excluded

R1-164221 Codebook design for {20,24,28,32} ports CATT
R1-164525 Discussion on codebook design for eFD-MIMO LG Electronics
R1-164929 Discussions of codebook enhancement for up to 32 ports ITRI
R1-164776 View on class A codebook extension Samsung
R1-164220 Antenna port layouts for Rel-14 FD-MIMO CATT
R1-165201 Codebook Enhancement for Non-precoded CSI-RS NTT DOCOMO, INC.
R1-164338 Codebook Design Supporting Antenna Configurations Up to 32 Ports Nokia, Alcatel-Lucent Shanghai Bell

6.2.3.2.2CSI reporting for hybrid CSI-RS

Hybrid between NP and BF CSI-RS or different types of BF CSI-RS

R1-164222 CSI reporting for hybrid CSI-RS CATT
R1-164339 Hybrid CSI measurement and reporting schemes Nokia, Alcatel-Lucent Shanghai Bell
R1-164431 Discussion on Hybrid CSI-RS Operation for eFD-MIMO Qualcomm Incorporated
R1-164526 Discussion on CSI reporting enhancements for hybrid CSI-RS LG Electronics
R1-165048 On Hybrid CSI-RS reporting scheme InterDigital

R1-165606 WF on Hybrid CSI Samsung, CATT, Interdigital, LG Electronics, Nokia, ALU Shanghai Bell, Qualcomm, Huawei, HiSilicon
R1-165617 Way Forward on Hybrid CSI Reporting ZTE, NTT DOCOMO, Beijing Xinwei Tech., NEC

Working assumption:
- Mechanism 1: Hybrid CSI is realized by with one CSI process, support at least CLASS A for the 1st eMIMO-Type and CLASS B with K=1 CSI-RS resource for the 2nd eMIMO-Type
  - i_1 is reported while CQI and i_2 are not reported for the 1st eMIMO-Type (CLASS A)
    - FFS: whether RI is reported for CLASS A
  - CQI/PMI/RI are reported for the 2nd eMIMO-Type (CLASS B K=1)
- At least one more mechanism is supported, to be discussed in RAN1#86

R1-164860 Discussion on Joint utilization of different types of CSI-RS Huawei, HiSilicon
R1-164770 Port-based CSI-RS overhead reduction Samsung
R1-164777 Hybrid PMI codebook based CSI reporting and simulation results Samsung
R1-165202 CSI Reporting for Hybrid CSI-RS NTT DOCOMO, INC.

R1-165920 WF on additional hybrid CSI mechanism NTT DOCOMO, LG Electronics, NEC, Qualcomm, Samsung

Conclusion:
- Candidate mechanisms to consider in RAN1#86
  - Mechanism 2A: for hybrid CSI with one CSI process, support CLASS B with K≥1 CSI-RS resources for the 1st eMIMO-Type and CLASS B with K=1 CSI-RS resources for the 2nd eMIMO-Type
    - For the 1st eMIMO-Type, depending on the value of K
      - K=1: CQI/RI are reported. In addition, i_1 is reported for Rel.12 dual-stage codebooks
      - K>1: two options
        - Option 1: CRI is reported

        - Option 2: PMI/RI for each CSI-RS resource are reported
    - For the 2nd eMIMO-Type
        - CQI/PMI/RI are reported
- Mechanism 2B: for hybrid CSI with one CSI process, support CLASS B with K≥1 CSI-RS resources for the 1st eMIMO-Type and CLASS B with K=1 CSI-RS resources for the 2nd eMIMO-Type
    - For the 1st eMIMO-Type, depending on the value of K
        - K=1:
            - Option 1: i_1 is reported for Rel.12 codebooks (when applicable) or i_2 for Rel.13 CLASS B codebooks
            - Option 2: CQI/RI are reported. In addition, PMI is reported for Rel.13 CLASS B codebooks
        - K>1: two options
            - Option 1: CRI is reported
            - Option 2: PMI/RI for each CSI-RS resource are reported
    - For the 2nd eMIMO-Type
        - CQI/PMI/RI are reported
- Mechanism 3: for hybrid CSI with one CSI process, CLASS A or CLASS B K=1 for the 1st eMIMO-Type and CLASS B K>1 for the 2nd eMIMO-Type
    - For the 1st eMIMO-Type: i_1 is reported
    - For the 2nd eMIMO-Type: two options
        - Option 1: CRI and CQI/PMI/RI for the recommended CSI-RS resource are reported
        - Option 2: CQI/PMI/RI for a CSI-RS resource
- Mechanism 4: Hybrid CSI reporting with CSI process pair
    - UE calculates CSI for only one CSI process at a time
- Mechanism 5: the proposal in R1-165617
- Other mechanisms are not precluded

- Down select from the above mechanisms and/or options in RAN1#86
- Each proposal should include clear description on use case(s) and specification impact
    - For CLASS B K=1, proponent needs to clarify whether both codebook options are applicable for not.

R1-164147 Evaluation of beam selection in Class B for hybrid FD-MIMO Intel Corporation
R1-164313 Discussion on CSI reporting for hybrid CSI-RS ZTE
R1-164778 CSI reporting for hybrid CSI-RS Samsung
R1-164880 Considerations on hybrid non-precoded CSI-RS and beamformed CSI-RS CMCC
R1-164895 Discussion on CSI reporting for hybird CSI-RS Beijing Xinwei Telecom Techn.
R1-165098 Hybrid CSI Reporting with One and Two CSI Processes Ericsson

6.2.3.2.3 Advanced CSI reporting and interference measurement

(Second priority) Evaluate and, if needed, specify enhancements on CSI reporting to improve eNB precoding and interference measurement for MU transmissions

R1-164781 LC based explicit CSI feedback and simulation results Samsung
R1-165100 High Resolution CSI feedback Ericsson
R1-164150 Explicit CSI reporting for FD-MIMO Intel Corporation
R1-165789 Initial performance evaluation on advanced implicit CSI LG Electronics
Revision of R1-164527
R1-164098 Enhancement on CQI measurement and feedback for MU-MIMO Huawei, HiSilicon
R1-165203 Advanced Interference Measurement and CSI Reporting NTT DOCOMO, INC.

R1-165801 WF on advanced CSI feedback Huawei, Hisilicon, China Unicom, China Telecom, Deutsche Telekom
Proposal:
- Specify at least Analog CSI feedback in Rel-14 with the following restrictions
    - CQI is quantized and CQI derivation is based on associated unquantized CSI (i.e. implicit feedback)
    - Only support Aperiodic feedback in Rel-14;
    - Only support {2, 4} ports per CSI-RS resource in Rel-14

R1-164090 CSI feedback for beam space MIMO Huawei, HiSilicon

R1-164659 Considerations on MU-CQI Transmission Sony
R1-164881 Enhancing interference measurement for MU transmissions CMCC

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R1-164097 Discussion and evaluation of analog CSI feedback Huawei, HiSilicon
R1-164148 Beam combining codebook enhancements for Class B FD-MIMO Intel Corporation
R1-164149 Discussion on the performance of CQI reporting based on the NZP CSI-RS Intel Corporation
R1-164223 On Interference enhancement for multi-user MIMO operation CATT
R1-164314 Discussion on CSI reporting of linear combination codebook ZTE
R1-164315 Discussion on interference measurement for MU-CSI ZTE
R1-164340 Initial Evaluation Results with Analog CSI Reporting Nokia, Alcatel-Lucent Shanghai Bell
R1-164432 Discussion on advanced CSI reporting and initial evaluation results Qualcomm Incorporated
R1-164779 Advanced CSI reporting paradigm Samsung
R1-164780 Linear combination (LC) codebook based CSI reporting and simulation results Samsung
R1-164782 Discussions on auxiliary CSI for MU transmission Samsung
R1-164783 Discussions on interference measurement enhancement in eFD-MIMO Samsung
R1-164856 Advanced CSI feedback framework for LTE Huawei, HiSilicon
R1-164897 Discussion on Advanced CSI Reporting Beijing Xinwei Telecom Techn.
R1-165099 Discussion on Interference Measurement Enhancements Ericsson

6.2.3.3 DMRS-based Open-Loop and Semi-Open-LoopTransmission

Evaluate and, if needed, specify necessary CSI reporting scheme and open-loop (without PMI feedback) as well as semi-open-loop (with reduced PMI feedback) transmission scheme

R1-165102 Email Summary: Use of 3D RMa Channel Model in Semi-Open Loop Evaluations Ericsson

Conclusion:

- No consensus to change RMa channel model assumptions for (semi-)open loop evaluations at present. Implications:
  - 2D RMa currently supported in evaluations is suitable for 1D horizontal arrays.
  - Companies bringing in preliminary results for FD-MIMO (2D) arrays will need to explain how they approximated a 3D model from the 2D ITU model
- Use of 3D RMa may be further discussed in evaluations during specification phase.
- Clarify that 2D RMa can be simulated with 30, 60, 120 kmph, as shown below.
- Amend slide 3 of R1-163832 as follows, leaving the 'UE Speed' row unchanged.

Parameters	Value
Scenarios	3D-UMa ISD 500m ~~(at 30km/h, 60kmph, and/or 120km/h)~~ RMa ISD 1732m~~(120km/h)~~ in ITU-R model [note: this is a 2D model]

R1-165407 DMRS-based Open-loop MIMO Ericsson
Revision of R1-165101
R1-164433 Discussion on DMRS based OL and Semi-OL Transmission Qualcomm Incorporated
R1-164859 Discussion on DMRS based open and semi open loop transmission Huawei, HiSilicon
R1-164341 Evaluation Results of DMRS-based open-loop transmission schemes Nokia, Alcatel-Lucent Shanghai Bell
R1-164224 Discussion on DMRS based open-loop MIMO CATT
R1-164225 Evaluation of DMRS-based open-loop and semi-open-loop MIMO CATT

R1-164528 Initial performance evaluation on semi-OL MIMO LG Electronics
R1-165288 Initial simulation results of DMRS based semi-open-loop MIMO CATR

R1-164151 Evaluation of open loop schemes Intel Corporation
R1-164316 Discussion on DMRS-based Open-Loop and Semi-Open-Loop Transmission ZTE
R1-164784 Discussions on open and semi-open loop transmission in eFD-MIMO Samsung
R1-164785 Evaluation results on semi-open loop transmission in eFD-MIMO Samsung
R1-164898 Discussion on Semi-Open-loop Transmission Beijing Xinwei Telecom Techn.
R1-165341 Discussions on DMRS based Open/Semi-open loop MIMO schemes CEWiT

R1-165790 WF on the three "evaluate and, if needed, specify" Items Nokia, Alcatel-Lucent Shanghai Bell, Samsung, CATT

Agreements:

- UL DMRS Enhancement
  - Specify enhancement on uplink DMRS to support (more than 2) orthogonal DMRS for MU-MIMO with partially overlapping BWs allocation, i.e. one of IFDMA with OCC2 or new DMRS sequence design
- Advanced CSI

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- Specify enhancement on CSI reporting to improve eNB precoding. The specified enhancement is to be selected from the following categories:
  - Enhancements to Rel-13 feedback codebooks (FFS which numbers of antenna ports from the set {8, 12, 16, 20, 24, 28, 32}) that increase CSI resolution through improved beam selection / construction in W1 and/or improved beam/port selection / combining / weighting mechanisms in W2
  - Parameters representing channel coefficients, or some reduced space representation thereof including beam combining / weighting with coefficient quantisation or channel quantisation or channel covariance matrix quantisation
    - Uplink physical channel enhancements to carry the representation of channel coefficients can be included if selected
- Also, interference measurement enhancement can be considered

- DMRS-based semi-open-loop
  - Specify enhancement to support DMRS-based semi-open-loop transmission with the existing numbers of CSI-RS ports as well as the newly supported number of CSI-RS ports, in the following areas
    - CSI reporting scheme with partial PMI feedback, and/or
    - Transmission method with transmit diversity and/or precoder cycling, with possible enhancements to precoder bundling
    - Associated enhancements to DMRS if required
  - Further system level simulations (e.g. considering wideband scheduling and BLER targets at high speed) will be conducted in order to identify the exact scheme to be specified.

Send LS to RAN plenary reflecting the above, with update to WID - R1-165493.

R1-165493 LS on Rel.14 eFD-MIMO WID update Nokia
Agreed in R1-166029

R1-165860 Draft LS on Rel.14 eFD-MIMO WID update Samsung

Agreement:
Change "RAN1 has agreed to request RAN to amend the WID as follows" to "RAN1 has agreed on the following"
The agreed LS is to be prepared in R1-165493 (Min)

6.2.4 Downlink Multiuser Superposition Transmission for LTE

WID in RP-160680
R1-165937 Chairman's Notes of Agenda Item 6.2.4 on MUST Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed

R1-165888 Draft LS on RAN1 Agreements in MUST MediaTek
The draft LS is approved in R1-165984, with the following updates:
- Remove the yellow parts
- Last paragraph is updated to:
  - For exact values of power ratios, although RAN1 concludes that R1-165763 and R1-165797 can be used as examples for further evaluation, RAN1 has not achieved consensus yet and further evaluations are to be performed in RAN1.

6.2.4.1 Superposition transmissions

Down select between single and multiple power ratios, potential power ratios, modulation, etc.
R1-164079 Discussion on power ratios for MUST Huawei, HiSilicon
R1-164282 Performance evaluation of MUST for selection of potential power ratios ZTE
R1-164435 Power ratio set considerations for MUST Qualcomm Incorporated
R1-164529 Discussion on power ratio and modulation order LG Electronics
R1-164977 Selection of Power Ratios and Modulation for MUST PDSCH MediaTek Inc.
R1-164997 On transmission power ratios for MUST Sharp
R1-165831 Discussion on power ratios optimization for MUST scheme NTT DOCOMO, INC.
Revision of R1-165204

R1-165764 WF on modulation order LG Electronics, Intel, MediaTek, NTT DOCOMO, ZTE, Nokia
Agreement:
- For Case 1 and 2 described in MUST WID, Far UE's modulation order is limited to QPSK when it is co-scheduled with near UE in a given subframe.

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R1-165796 Way Forward on MUST Power Ratio MediaTek, China Unicom, CHTTL, Huawei, HiSilicon, HTC, III, Intel, ITRI, LG, NTU, Sharp, Sony, ZTE
Also supported by CMCC
Agreement:

- For MUST Case 1 and Case 2, multiple power ratios are supported at least for some combinations of MUST-near UE and MUST-far UE modulation orders
  - For case 3, FFS

R1-165763 Way Forward on MUST Power Ratio Set Qualcomm
R1-565765 WF on power ratios LG Electronics, ZTE, Nokia
Agreement:

- For Case 1 and 2, and for each combination of modulation order,
  - The number of power ratios generating non-uniform composite constellation should be chosen from 0 (for some combinations, if any), 1, 2 or 3.
    - The details are FFS.
  - Power ratios generating non-uniform composite constellation should be selected from the range [0.7, 0.95].
    - The values of power ratio is FFS.
    - 0.7 should be excluded in case of 64QAM (for near UE) + QPSK (for far UE).

R1-165797 Way Forward on MUST Transmission MediaTek, ASUSTEK COMPUTER (SHANGHAI), CHTTL, Huawei, HiSilicon, HTC, III, ITRI, NTT DOCOMO INC., NTU, Sharp, ZTE
R1-165798 Way Forward on MUST Transmission when MUST-Far UE Has 16QAM MediaTek, CHTTL, Huawei, HiSilicon, HTC, III, ITRI, NTU, Sharp

Conclusion:

- Companies are encouraged to perform more evaluations especially regarding the detailed set of power ratio(s) for each combination (**e.g.**, refer to the WFs in R1-165763, R1-165797 as an example)

R1-164152 Discussion on superposition transmission Intel Corporation
R1-164226 Selection of superposition transmission scheme and parameterization CATT
R1-164281 Multiuser superposition transmission scheme for LTEZTE
R1-164434 Superposition transmissions Qualcomm Incorporated
R1-164530 Discussion on Gray mapping for superposed constellation LG Electronics
R1-164593 down-selection for superposition scheme Sequans Communications
R1-164816 Constellation combinations in MUST with legacy composite constellations Huawei, HiSilicon
R1-164978 Discussion on the EVM requirement for MUST MediaTek Inc.
R1-165136 MUST Case 1 and 2 schemes Nokia, Alcatel-Lucent Shanghai Bell
R1-165369 Power ratio and modulation order for MUST with HARQ National Taiwan University

6.2.4.2 Mechanisms for efficient operation

Related to RRC signaling, DCI, UE blind detection, etc.

R1-164153 On downlink control signalling for MUST Intel Corporation
R1-164227 Support of downlink superposition transmission CATT
R1-164345 Discussion on control signalling of MUST Fiberhome Technologies Group
R1-165135 On network assistance and operation of MUST Nokia, Alcatel-Lucent Shanghai Bell
R1-164979 Blind detection evaluation on interference existence for Case 1MediaTek Inc.

R1-165799 Way Forward on Mechanism for MUST operation MediaTek, China Telecom, CHTTL, CMCC, Huawei, HiSilicon, HTC, III, ITRI, NTT DOCOMO INC., NTU, Sharp, Sony, ZTE
Agreement:

- No new TM for MUST
- MUST Case 1 and Case 2 using up to 2Tx is supported in the following TMs
  - TM 2/3/4
  - FFS TM 8/9/10
- A UE is signalled by RRC if it is to be configured for potential MUST operation
- FFS MUST Case 3 using up to 8Tx is supported in the following TMs
  - TM 4/8/9/10
  - Companies are encouraged to perform more evaluations especially using the agreed FTP model
- At least one new DCI is to be monitored by a UE once configured into MUST operation
  - FFS on details

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- FFS MUST-near UE may assume MUST interference presence/absence is consistent among all of its scheduled PRBs for CRS-based TM and DMRS-based TM

R1-165793 Way forward on transmission mode for MUST ZTE, NEC, MediaTek, Sequans
Also supported by Sharp
Agreement:
- For MUST case 1/case 2/case 3, dynamic switching between MUST and non-MUST operation is supported
- Maximum number of spatial layers for MUST
  - For MUST case 1 and case 2, up to 2 spatial layers for each UE are used.
  - For MUST case 3, the maximum number of spatial layers for a UE should be limited, with details FFS.

R1-165794 Way forward on DCI transmission for MUST ZTE, MediaTek, Qualcomm
R1-165803 Way Forward on MUST codewords multiplexing Huawei, HiSilicon, MediaTek, ZTE
R1-165881 WF on far UE spec impact LG Electronics, Intel, ASUSTeK, ZTE

R1-164080 Signaling mechanisms for MUST Huawei, HiSilicon
R1-164283 Method to provide assistance information to a UE ZTE
R1-164284 Potential mechanisms for MUST operation ZTE
R1-164436 Mechanisms for efficient operation Qualcomm Incorporated
R1-164478 Discussion on candidate assistance information for signalling or blind detection NEC
R1-164531 Discussion on Signaling Assistance Information LG Electronics
R1-164594 initial configuration and dynamic indication Sequans Communications
R1-164669 Considerations of Efficient Control Signaling for MUST Sony
R1-164980 Mechanisms for Operation of MUST MediaTek Inc.
R1-164981 Downlink power allocation for MUST MediaTek Inc.
R1-165068 Operation mechanism for MUST case 1 and case 2 China Telecommunications
R1-165137 On the specification approach of MUST Nokia, Alcatel-Lucent Shanghai Bell
R1-165205 Discussion on remaining issues and signaling design for DL MUST NTT DOCOMO, INC.
R1-165265 Discussion on Downlink Control Signaling for MUST ASUSTEK COMPUTER (SHANGHAI)
R1-165736 Feasibility of interference presence blind detection in CASE 1 MUST Nokia, Alcatel-Lucent Shanghai Bell
Late submission

6.2.4.3 Evaluation for MUST using up to 8Tx

R1-164285 Evaluation for MUST using up to 8Tx antennas ZTE
R1-164882 Updated Evaluation results for MUST using 8Tx with different precoders CMCC
R1-164982 Preliminary evaluation results for MUST Case 3 MediaTek Inc.
R1-165138 System-level Evaluation of Case 1 and 3 MUST Nokia, Alcatel-Lucent Shanghai Bell
R1-165206 Evaluation for CRS-based MUST with 4 Tx antennas NTT DOCOMO, INC.

6.2.4.4 Others

R1-164437 MUST UE pairing with existing CQI feedback Qualcomm Incorporated
R1-164832 Consideration on implementation for MUST transmitter Huawei, HiSilicon

6.2.5 eMBMS enhancements for LTE

WID in RP-160675
R1-165938 Chairman's Notes of Agenda Item 6.2.5 on eMBMS Session Chairman, Rapporteur (Ericsson)
Contents incorporated below
Endorsed with following update

Longer cyclic prefix for MBSFN subframe

R1-164082 Evaluations of different numerologies for eMBMS Huawei, HiSilicon
R1-164438 Evaluation results for longer cyclic prefix Qualcomm Incorporated
R1-165437 System simulation results for longer CP in MBSFN subframes Ericsson
Update of R1-165219
R1-165342 MBSFN Measurements Alcatel-Lucent Shanghai Bell

R1-164154 On the support of longer cyclic prefix for MBSFN subframes Intel Corporation
R1-164439 Design options for longer cyclic prefix for MBSFN subframes Qualcomm Incorporated

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R1-165220 Link level simulation assumptions for evaluation of longer CP for MBSFN subframes Ericsson

Offline discussion to develop simulation assumptions – Joerg Huschke (Ericsson) - R1-165438 (email approval until 30th June)

6.2.5.2 Increased number of MBSFN subframes per radio frame

R1-164440 Increased number of MBSFN subframes per radio frame Qualcomm Incorporated
R1-164155 On the support of increased number of MBSFN subframes per radio frame Intel Corporation
R1-165221 Radio frame design for extended MBSFN subframe allocation Ericsson

R1-164083 Radio frame design for increased number of MBSFN subframes Huawei, HiSilicon
R1-164306 Consideration on increasing number of MBSFN subframes ZTE
R1-165222 DRS design for carrier with extended MBSFN subframe allocation Ericsson

6.2.5.3 MBSFN subframes without a unicast control region and cell-specific reference signals

R1-164156 On the support of MBSFN subframes without a unicast control region and cell-specific reference signals Intel Corporation
R1-164307 Consideration on support of MBSFN subframes without a unicast region ZTE
R1-164441 MBSFN subframes without a unicast control region and cell-specific reference signals Qualcomm Incorporated

R1-164849 On MBSFN subframes without a unicast control region and cell-specific reference signals Huawei, HiSilicon
R1-165223 Unicast control region configuration for eMBMS enhancements Ericsson

6.2.5.4 Others

R1-164442 Standalone eMBMS carrier Qualcomm Incorporated
R1-164443 Simultaneous reception of broadcast and unicast Qualcomm Incorporated
R1-165340 Considerations for eMBMS Nokia, Alcatel-Lucent Shanghai Bell

Way Forwards

R1-165609 eMBMS WF unicast control region, incl. CRS Ericsson, Qualcomm, BBC, EBU
R1-165611 eMBMS WF link level simulations and RS design Ericsson, Qualcomm, BBC, EBU
R1-165615 WF on system information and idle mode reception for eMBMS enhancements Qualcomm, EBU, BBC, Ericsson

R1-165610 Way Forward on longer CP for MBSFN Ericsson, Qualcomm, BBC, EBU
R1-165614 **WF** on numerology supported in MBSFN subframes Huawei, HiSilicon, Orange, Intel, ZTE

R1-165846 eMBMS WF after offline Ericsson, Qualcomm, BBC, EBU, Nokia, ASB, Dish, AT&T, Telstra, Fraunhofer IIS

Proposed agreement

- If a carrier is operated with 100% MBSFN subframe allocation, a single CP longer than or equal to X is supported
  - It is understood 100% MBSFN subframe allocation allows for non-MBSFN subframes set aside for e.g. cell search, SI
  - 100% MBSFN subframe allocation applies to objective b), and objective d) if specified
  - This carrier does not have unicast control in the MBSFN subframes
    - FFS: Where to indicate MCCH change notifaction
- For a carrier that is operated with 100% MBSFN subframe allocation, legacy CPs are supported
  - FFS whether it is needed to have unicast control on this carrier
- FFS whether the longer CP numerology can be supported in carriers with less than 100% MBSFN subframe allocation
- If a carrier supports mixed unicast and MBMS, at least 2 subframes separated by 5ms are non-MBSFN subframes
- eMBMS enhancements do not require changes to any channels and signals needed for MBMS operation except PMCH and MBSFN-RS
  - FFS whether use of more REs, TTI extension and/or change in payload are needed for PBCH coverage enhancements.

Petitioners' Exhibit 1007, p. 1886
AT&T et al v. Asustek Technology & Celerity
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Proposed working assumption: x=100us, need for more evaluation
Email approval about above proposed agreements and proposed working assumptions until 30th June – Alberto (Qualcomm)

Huawei: is first proposal for standalone only? If so it is for study only.
Qualcomm: also applies to objective b), not only for standalone
ZTE, Huawei believe should be only for standalone operation
Telstra emphasizes need for support of large ISD not only for standalone but in existing spectrum
Huawei: What is standalone?
Ericsson: a carrier operating on its own. Currently MBMS on SCell does not work for Telstra because their ISDs are too large.
Huawei: So this is for mixed ISD? Has not been evaluated.
Telstra: Has taken it as given that CP for 15km will be specified, reading from WI
Ericsson: Mixed unicast/MBMS does not have to be evaluated separately. Addressing real operator problem.
Huawei: Can 15km ISD really provide contiguous PCell coverage.
Huawei: Proposes to have more time to evaluate longer CP scenario

Pro: Nokia, ASB, Qualcomm, Ericsson, BBC, EBU, Dish, Fraunhofer, KT, Telstra
Con: Huawei, HiSilicon, ZTE, Orange

6.2.6 SRS Carrier Based Switching for LTE

WID in RP-160676

R1-165939 Chairman's Notes of Agenda Item 6.2.6 on SRS Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed

R1-165054 An additional requirement on SRS switchingSoftBank Corp.
Conclusion:

- Companies are encouraged to check R1-165054, especially considering input from RAN4
- Revisit in RAN1#86

6.2.6.1 SRS Transmission on TDD CCs without PUSCH

Including power control, timing advance, and possible new symbol positions

R1-164107 SRS subframe design for SRS carrier based switchingHuawei, HiSilicon
R1-164228 Considerations on SRS carrier based switching CATT
R1-164444 SRS Transmission on TDD CCs without PUSCH Qualcomm Incorporated
R1-164786 SRS Transmission without PUSCH Samsung
R1-164936 On SRS transmission on TDD CCs without PUSCH Ericsson

R1-165760 Way Forward on SRS Transmission on TDD CCs without PUSCH Huawei, HiSilicon
Agreement:

- Support non-contention based PRACH transmission over SRS Scell without PUSCH
  - Re-using existing procedure
- Timing advance commands are supported for SRS Scell without PUSCH
  - Re-using existing procedure
- Support power control mechanism for SRS transmission in cells without configured PUSCH transmission
  - Specify power control parameters for SRS transmission without PUSCH.
    - Aim for re-using existing parameters. Details FFS
  - Specify closed-loop power control signaling. Details FFS
  - Specify power headroom reports. Details FFS
  - FFS specify dropping/power scaling rules. Details FFS

Agreement:

- As defined in Rel-13, for SRS carrier based switching, the SRS transmission opportunities include:
  - In at least one symbol out of up to 6 symbols in a special subframe
  - In the last symbol of a UL subframe
  - Note: from UE perspective, there may be impact on SRS transmission opportunities due to switching time depending on RAN4 input
- FFS whether or not to further allow more symbol positions for SRS transmissions on a switching-to carrier in special subframes, UL subframes and/or after the control region in MBSFN subframes

Petitioners' Exhibit 1007, p. 1887
AT&T et al v. Asustek Technology & Celerity
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R1-164108 Power control for SRS on TDD CCs without PUSCH Huawei, HiSilicon
R1-164109 Timing advance for SRS on TDD CCs without PUSCH Huawei, HiSilicon
R1-164157 Consideration on Support SRS Carrier based Switching Intel Corporation
R1-165281 UL transmission on DL-only carrier for SRS carrier based switching Nokia, Alcatel-Lucent Shanghai Bell

6.2.6.2 Support of Periodic and/or aperiodic SRS

R1-164110 Support of periodic and/or aperiodic SRS Huawei, HiSilicon
R1-164937 On Periodic and aperiodic SRS switching Ericsson
R1-165075 Support of SRS transmission switching Intel Corporation
R1-165282 Discussion on SRS transmission triggering Nokia, Alcatel-Lucent Shanghai Bell

R1-165761 Way Forward on Support of Periodic and/or Aperiodic SRS Huawei, HiSilicon, Softbank
Agreement:

- Aperiodic SRS on a CC without PUSCH is supported for SRS carrier-based switching
  - Details FFS
- Periodic SRS on a CC without PUSCH is supported for SRS carrier-based switching
  - Details FFS
  - Strive for minimizing additional complexity (w.r.t. A-SRS), if any, and additional specification impact for supporting P-SRS

R1-164445 Support of Periodic and/or aperiodic SRS Qualcomm Incorporated
R1-164787 P-SRS and A-SRS Transmission with Carrier Switching Samsung

6.2.6.3 Collision Handling

R1-164446 Collision Handling Qualcomm Incorporated
R1-164788 SRS Collisions due to Carrier Switching Samsung
R1-165283 Collision handling for SRS carrier based switching Nokia, Alcatel-Lucent Shanghai Bell

R1-165762 Way Forward on Collision Handling Huawei, HiSilicon, Qualcomm
Agreement:

- To handle collision due to SRS carrier-based switching
  - Define priority/dropping rules by taking into account the factors including periodic/aperiodic SRS type, channel/UCI type, and PCell/SCell type
    - Rel-13 collision handling rules between SRS and other UL transmissions as baseline, taking into account switching time based on input from RAN4
    - Details FFS
  - FFS shortened PUSCH format and possible mechanisms to mitigate the effect of puncturing (e.g. power control, different beta value for UCI).
  - FFS approaches to help avoid collision, e.g.,
    - Introduction of different HARQ timing (e.g. by introduction of HARQ reference subframes)
    - Introduction of flexible A-SRS transmission timing
    - Group DCI for A-SRS triggering

R1-164111 Collision handling for SRS carrier based switching Huawei, HiSilicon
R1-164938 On collision handling of SRS and channels on other carriers Ericsson

6.2.6.4 Others

R1-164081 SRS carrier based switching for UEs with multiple antennas Huawei, HiSilicon
Conclusion:

- Discuss further for the case when UEs have more than one receiving antenna but only one transmitting antenna at one time, how to handle the transmit antenna for SRS
  - Note: this may be related to UE capability

6.2.7 Further Indoor Positioning enhancements for UTRA and LTE

WID in RP-160538
R1-165940 Chairman's Notes of Agenda Item 6.2.7 on enh_Ind_Pos Session Chairman (Qualcomm Inc.)
Contents incorporated below

Petitioners' Exhibit 1007, p. 1888
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Endorsed

6.2.7.1 OTDOA Enhancements

R1-163976 TP-specific PRS sequence generation for indoor positioning Ericsson
R1-163977 PRS pattern enhancements for indoor positioning Ericsson
R1-163978 Richer RSTD reporting for indoor positioning Ericsson
R1-164350 Draft LS on OTDOA enhancements for indoor positioning Ericsson
R1-164447 Introduction of OTDOA enhancements for the shared Cell-ID scenario Qualcomm Incorporated
R1-164448 Draft CR Introduction of OTDOA enhancements for the shared Cell-ID scenario Qualcomm Incorporated
R1-164449 Introduction of UE inter-frequency RSTD calibration accuracy reporting Qualcomm Incorporated
R1-164661 Adaptive RSTD reporting for indoor positioning Ericsson
R1-164668 OTDOA Enhancement for Same PCI Issue Nokia, Alcatel-Lucent Shanghai Bell
R1-164852 VCID PRS sequence generation Huawei, HiSilicon
R1-165232 OTDOA enhancement Intel Corporation

R1-165553 WF on OTDOA for the same PCI Huawei, HiSilicon, Intel, ZTE
Agreement:

- For OTDOA same PCI, RAN1 decides to:
  - Define $N_{\mathrm{ID}}^{\mathrm{PRS}}$ for PRS sequence/vshift generation per TP
    - With $N_{\mathrm{ID}}^{\mathrm{PRS}}$ values ranging FFS
- Send LS to RAN2 and RAN3 for signaling design (including agreements from last meeting) – Xue Jiantao (HW)
  - Draft LS is in **R1-165835**, approved in R1-165853 with the following update:
    - CC RAN4

6.2.7.2 PRS-based Beacons

R1-163979 On PRS-based beacons for indoor positioning Ericsson
R1-164450 Introduction of PRS based Terrestrial Beacon Systems Qualcomm Incorporated
R1-164451 Way Forward on PRS-based Beacons Qualcomm Incorporated
R1-165825 Way Forward on PRS-based Beacons Qualcomm Incorporated
Agreement:

- For PRS-based TBS, as a starting point for Rel-14 WI, RAN1 decides to prioritize the following:
  - Support PRS-based TBS where the TPs transmit positioning reference signals with the same general design as defined for eNBs in Rel-14.
  - The PRS for the TBS TPs can be configured in up to all 10 subframes within a radio frame.
  - The PRS for the TBS TPs can be configured in up to all radio frames of a DL carrier.

6.2.7.3 E-CID Enhancements

R1-163980 E-CID enhancements for indoor positioning Ericsson
R1-164853 Discussion on the same PCI case for E-CID enhancements Huawei, HiSilicon
R1-164854 Discussion on the UE Rx-Tx measurement over multiple serving cells Huawei, HiSilicon
R1-165552 WF on E-CID for the same PCI Huawei, HiSilicon
R1-165834 WF on E-CID for the same PCI Huawei, HiSilicon
Proposal:

- RAN1 decides to prioritize the following for the same PCI E-CID enhancement
  - Support CSI-RSRP reporting to E-SMLC
    - Note: this is only supported when the UE is configured with CSI-RS based DRS
    - Detailed reporting is up to RAN2/RAN3
  - Send LS to RAN2 and RAN3 for signaling design - Xue Jiantao (HW)
- Note: Other E-CID enhancements are not precluded

Further discussion offline

6.2.7.4 Others

R1-163981 Indoor/outdoor classification for indoor positioning Ericsson

6.2.8 Uplink Capacity Enhancements for LTE

WID in RP-160664

Petitioners' Exhibit 1007, p. 1889
AT&T et al v. Asustek Technology & Celerity
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Finalize the design of MCS table and the remaining details to support UL 256QAM.

R1-165951 Chairman's Notes of Agenda Item 6.2.8 on Uplink Capacity enhancement Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

MCS & TBS Tables
R1-164850 Evaluation results for UL 256QAM Huawei, HiSilicon
R1-164091 TBS table design for UL 256QAM Huawei, HiSilicon
R1-164092 MCS table design for UL 256QAM Huawei, HiSilicon
R1-164453 MCS table design considerations for UL 256QAM Qualcomm Incorporated
R1-164883 Discussion on UL 256QAM design CMCC
R1-165320 Further Discussion on MCS Table Design for UL 256QAM Ericsson
R1-165321 Design Principles for New UL 256 QAM MCS Entries Ericsson
R1-165322 New TBS Designs Supporting UL 256QAM Ericsson

R1-165880 WF on UL 256QAM TBS table Huawei, HiSilicon, CMCC, CATR, China Unicom, China Telecom, ZTE, Deutsche Telekom, Sprint, AT&T

Agreements:
- Introduce at least a new TBS index for 256QAM supporting a code rate of around 948/1024
- Principles for design of new TBS entries:
  - Reuse Rel-8-12 design principles, including:
    - Use of same code block sizes for a given entry
    - Max TBS given by 100PRB size
    - Aligned with QPP principle
  - The following MCS/TBS entries are removed:

MCS	MO	TBS
1	2	1
3	2	3
5	2	5
7	2	7
9	2	9
11	4	10
16	4	15
21	6	19
28	6	26

- Introduce 6 MCS values for 256QAM:
  - TBS indices 30, 31, 32, 32A (new), 33, 34 (new)

MCS	Modulation Order	TBS
23	8	30
24	8	31
25	8	32
26	8	32A
27	8	33
28	8	34

r x 1024	SE
700.8333	5.4753
as in spec	as in spec
763.7500	5.9668
829.5417	6.4808
895.3333	6.9948
948.0000	7.4063

I_{TBS}	N_{PRB}									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
32A	904	1864	2792	3752	4584	5544	6456	7480	8248	9144
34	1032	2088	3112	4264	5160	6200	7224	8504	9528	10296

I_{TBS}	N_{PRB}									
	11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
32A	10296	11064	12216	12960	14112	14688	15840	16416	17568	18336
34	11448	12576	13536	14688	15840	16992	17568	19080	19848	20616

I_{TBS}	N_{PRB}									
	21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
32A	19848	20616	21384	22152	22920	24496	25456	26416	27376	27376
34	22152	22920	24496	25456	26416	27376	28336	29296	30576	31704

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I_{TBS}	N_{PRB}									
	31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
32A	28336	29296	30576	31704	32856	32856	34008	35160	36696	36696
34	32856	34008	35160	35160	36696	37888	39232	39232	40576	42368

I_{TBS}	N_{PRB}									
	41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
32A	37888	39232	40576	40576	42368	42368	43816	43816	45352	46888
34	42368	43816	45352	46888	46888	48936	48936	51024	51024	52752

I_{TBS}	N_{PRB}									
	51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
32A	46888	48936	48936	51024	51024	52752	52752	52752	55056	55056
34	52752	55056	55056	57336	57336	59256	59256	61664	61664	63776

I_{TBS}	N_{PRB}									
	61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
32A	57336	57336	59256	59256	59256	61664	61664	63776	63776	63776
34	63776	63776	66592	66592	68808	68808	71112	71112	71112	73712

I_{TBS}	N_{PRB}									
	71	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
32A	66592	66592	68808	68808	68808	71112	71112	73712	73712	73712
34	75376	76208	76208	78704	78704	78704	81176	81176	81176	84760

I_{TBS}	N_{PRB}									
	81	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
32A	75376	76208	76208	78704	78704	78704	81176	81176	81176	84760
34	84760	84760	87936	87936	87936	90816	90816	93800	93800	93800

I_{TBS}	N_{PRB}									
	91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
32A	84760	84760	87936	87936	87936	87936	90816	90816	90816	93800
34	93800	97896	97896	97896	97896	101840	101840	101840	105528	105528

I_{TBS}	N_{PRB}									
	101	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**
32A	93800	93800	93800	97896	97896	97896	97896	101840	101840	101840
34	105528	105528	105528	105528	105528	105528	105528	105528	105528	105528

- 2-layer mapping:

TBS_L1	TBS_L2
101840	203704
105528	211936

Signalling and UE cats

R1-165319 Remaining Physical Layer Design Aspects of UL 256QAM Ericsson
R1-164093 Physical layer aspects for UL 256QAM Huawei, HiSilicon
R1-164944 On 256QAM to 64QAM MCS table fall-back Nokia, Alcatel-Lucent Shanghai Bell
R1-164452 Discussion of UL 256QAM Qualcomm Incorporated

Agreement:

- Signalling of 256QAM MCS table:
  - Separately for DCI formats 0 & 4

R1-164943 On 256QAM UL UE categories and UE capability signalling Nokia, Alcatel-Lucent Shanghai Bell
R1-165495
Agreement:

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- Introduce the 256QAM extension also for UL UE category 8 (in addition to the already agreed extensions of UL Categories 5, 13 and 14).
- The following 2 tables are agreed:

UE UL Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL	Support for 256QAM in UL
UL Category 0	1000	1000	No	No
UL Category 3	51024	51024	No	No
UL Category 5	75376	75376	Yes	No
UL Category 7	102048	51024	No	No
UL Category 8	1497760	149776	Yes	No
UL Category 13	150752	75376	Yes	No
UL Category 14	9585664	149776	Yes	No
UL Category 15	105528	105528	Yes	Yes
UL Category 16	2119360	211936	Yes	Yes
UL Category 17	211056	105528	Yes	Yes
UL Category 18	13563904	211936	Yes	Yes

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UE DL Category	UE UL Category	UE categories
DL Category 0	UL Category 0	N/A
DL Category 6	UL Category 5	Category 6, 4
DL Category 6	UL Category 15	Category 6, 4 DL Category 6 and UL Category 5
DL Category 7	UL Category 13	Category 7, 4
DL Category 7	UL Category 17	Category 7, 4 DL Category 7 and UL Category 13
DL Category 9	UL Category 5	Category 9, 6, 4
DL Category 9	UL Category 15	Category 9, 6, 4 DL Category 9 and UL Category 5
DL Category 10	UL Category 13	Category 10, 7, 4
DL Category 10	UL Category 17	Category 10, 7, 4 DL Category 10 and UL Category 13
DL Category 11	UL Category 5	Category 11, 9, 6, 4
DL Category 11	UL Category 15	Category 11, 9, 6, 4 DL Category 11 and UL Category 5
DL Category 12	UL Category 13	Category 12, 10, 7, 4
DL Category 12	UL Category 15	Category 12, 10, 7, 4 DL Category 12 and UL Category 13
DL Category 13	UL Category 3	Category 6, 4
DL Category 13	UL Category 5	Category 6, 4
DL Category 13	UL Category 7	Category 7, 4
DL Category 13	UL Category 13	Category 7, 4
DL Category 13	UL Category 15	Category 6, 4 DL Category 13 and UL Category 5
DL Category 13	UL Category 17	Category 7, 4 DL Category 13 and UL Category 13
DL Category 14	UL Category 8	Category 8, 5
DL Category 14	UL Category 16	Category 8, 5 DL Category 14 and UL Category 8
DL Category 15	UL Category 3	Category 11, 9, 6, 4
DL Category 15	UL Category 5	Category 11, 9, 6, 4 DL Category 11 and UL Category 5
DL Category 15	UL Category 7	Category 12, 10, 7, 4
DL Category 15	UL Category 13	Category 12, 10, 7, 4 DL Category 12 and UL Category 13
DL Category 15	UL Category 15	Category 11, 9, 6, 4 DL Category 11 and UL Category 5 DL Category 15 and UL Category 5
DL Category 15	UL Category 17	Category 12, 10, 7, 4 DL Category 12 and UL Category 13 DL Category 15 and UL Category 13
DL Category 16	UL Category 3	Category 11, 9, 6, 4
DL Category 16	UL Category 5	Category 11, 9, 6, 4 DL Category 11 and UL Category 5
DL Category 16	UL Category 7	Category 12, 10, 7, 4
DL Category 16	UL Category 13	Category 12, 10, 7, 4 DL Category 12 and UL Category 13
DL Category 16	UL Category 15	Category 11, 9, 6, 4 DL Category 11 and UL Category 5 DL Category 16 and UL Category 5
DL Category 16	UL Category 17	Category 12, 10, 7, 4 DL Category 12 and UL Category 13 DL Category 16 and UL Category 13
DL Category 17	UL Category 14	Category 8, 5 DL Category 14 and UL Category 8
DL Category 17	UL Category 18	Category 8, 5 DL Category 14 and UL Category 8 DL Category 17 and UL Category 14

Send these UE cat and RRC signalling related agreements to RAN2 in an LS - R1-165496 – Sorour (E///)
R1-165496 [DRAFT] LS on Uplink Capacity Enhancements for LTE Ericsson
R1-166017 [DRAFT] LS on Uplink Capacity Enhancements for LTE Ericsson
Agreed in R1-166034

PUSCH in UpPTS
For information preparatory to starting detailed work at RAN1#86:

Petitioners' Exhibit 1007, p. 1893
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R1-164884 Discussion on PUSCH transmission for UpPTS CMCC
R1-164851 Initial discussion on UL PUSCH in TDD special subframes Huawei, HiSilicon

6.2.9 Study on LTE-based V2X Services

SID in RP-160657
R1-165941 Chairman's Notes of Agenda Item 6.2.9 on V2X Session Chairman (Nokia)
Contents incorporated below
Endorsed with following updates

R1-164532 3GPP TR 36.885 v.1.1.0 Study on LTE-based V2X Services LG Electronics

6.2.9.1 Evaluation results

To collect the evaluation results to be included in TR36.885
R1-164533 Discussion on collecting V2X evaluation results in TR36.885 LG Electronics
Updated in R1-165795
Companies provide results according to R1-165795 by this Friday.
Email approval of TP for TR including approval of next version of TR and updated simulation results by 2nd June – Hanbyul (LGE)

6.2.9.1.1 Uu transport for V2V, V2P, and V2I/N

Including evaluation of the feasibility in terms of meeting latency requirements, network coordination required, resource efficiency, and energy efficiency of UE

Simulation results
R1-164158 Performance analysis of Uu broadcast transmission schemes for V2V communication Intel Corporation
R1-164454 System level performance using SC-PTM and eMBMS Qualcomm Incorporated
R1-164534 Evaluation results on the enhancement of Uu transport for V2V, V2P and V2I/N LG Electronics
R1-164789 Evaluation results for Uu based V2X Samsung (not available)

6.2.9.1.2 PC5 transport for V2P and V2I/N

Including potential V2V performance degradation

Simulation results
R1-164230 Evaluation results on PC5-based V2P CATT
R1-164231 Evaluation results on PC5-based V2I CATT
R1-164535 Evaluation results on PC5 transport for V2P and V2I/N LG Electronics
R1-164790 Evaluation results for PC5 based V2P and V2I/N Samsung
R1-164861 Evaluation results for PC5-based V2X Huawei, HiSilicon
R1-165207 Evaluation of PC5 transport for V2P/V2I/I2V communications NTT DOCOMO, INC.

V2P enhancement (under agenda 6.2.9.2.3**)**
R1-165275 Discussion on P2x-x2P Ericsson
R1-164229 Discussion on resource allocation for PC5-based P2V CATT
R1-164455 PC5 for V2P Qualcomm Incorporated

6.2.9.1.3 Others

6.2.9.2 Support of Uu transport for V2V, and PC5/Uu transport for V2I/N and V2P

6.2.9.2.1 Enhancement to DL multicast/broadcast transmissions

Including details of how to enable the enhancements identified in RAN1#84bis

Overview on all the aspects
R1-164456 Downlink Enhancements for Uu based V2V Qualcomm Incorporated
R1-165254 Downlink Enhancements for V2X Ericsson

Petitioners' Exhibit 1007, p. 1894
AT&T et al v. Asustek Technology & Celerity
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R1-165815 WF on DL broadcast enhancement for V2X LG Electronics, Deutsche Telekom, III, ITL, KRRI, KT Corporation, LG Uplus, Samsung, SK Telecom, Xinwei
Proposal:

- A set of enhancements concluded as beneficial in RAN1#84bis can be implemented by supporting the following feature:
  - V2X messages are broadcast ~~via TM-10-DM-RS-based PDSCH scheduled by (E)PDCCH~~, e.g. by:~~:~~
    - ~~The current SC-PTM is extended to support TM-10 for broadcast from a single eNB.~~
  - A CP length shorter than extended CP ~~PMCH~~ in the current MBSFN architecture ~~is replaced by this PDSCH~~ for broadcast from multiple eNBs.
  - Issues to be considered to support this include
    - DCI format/content and the search space
    - Quasi-colocation, rate matching, RS sequence generation
    - OL precoding and CSI feedback

R1-165960 Way forward on DL and PC5 for V2X LG Electronics, Huawei, HiSilicon, Ericsson, NTT DOCOMO, Samsung, Panasonic, Nokia, ASB

Multicast/broadcast area decision according to Geo-info
R1-164325 Discussion on enhancement to DL multicast/broadcast transmissions Fujitsu
R1-164970 Enhancement to DL multicast/broadcast transmissions ZTE

R1-164159 Discussion on multi-cell multicast/broadcast enhancements for V2V communication Intel Corporation
R1-164326 Multicast/Broadcast enhancements for V2X Fujitsu

CoMP and MIMO enhancement
R1-164536 Further details on enhancements for multi-cell multicast/broadcast LG Electronics
R1-164791 MIMO support for V2X multicasting Samsung

UE feedback
R1-164057 Uu DL enhancements for V2X Huawei, HiSilicon
R1-164537 Discussion on UE feedback for DL multicast/broadcast LG Electronics

R1-165729 WF on HARQ Feedback LG Electronics, Huawei, ITRI
Conclusion to be captured in the technical part of the TR:

- In the event that HARQ feedback for DL multicast/broadcast transmissions were to be introduced, at least in a single cell, two options are identified for HARQ feedback resource allocation:
  - UE-common resource: Multiple UEs receiving the same DL multicast/broadcast transmission transmit HARQ feedback on the same resource.
  - UE-specific resource: Different UEs receiving the same DL multicast/broadcast transmission transmit HARQ feedback on different resources.

6.2.9.2.2 Enhancements to unicast

Including UL enhancement (e.g., SPS enhancement, SR enhancement)
R1-164538 Discussion on UL SPS for V2X LG Electronics
R1-164580 Discussion on SR Enhancements for V2X Spreadtrum Communications
R1-164971 Uu transport enhance for V2X ZTE
R1-165274 UL SPS and reporting to eNB for V2X Ericsson

6.2.9.2.3 Enhancements to sidelink

Including details of resource selection in pedestrian UEs

Whether to support P UE transmit only
R1-164819 Power consumption analysis of PC5 V2P Huawei, HiSilicon
R1-165275 Discussion on P2x-x2P Ericsson

Observation: the motivation to support random resource selection/partial sensing is at least for power saving purpose.
Note: RAN1 has not evaluated potential cost reduction.

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Resource allocation and sensing for P UE

R1-165208 Further detail of partial sensing for P2V operation NTT DOCOMO, INC.
R1-164972 Discussion on V2P design aspects ZTE
R1-164229 Discussion on resource allocation for PC5-based P2V CATT
R1-164455 PC5 for V2P Qualcomm Incorporated
R1-164935 Zone based dynamic resource management in V2X service ITRI

Other

R1-164539 Discussions on SL enhancements for V2P LG Electronics(not available)

6.2.9.2.4 Others

6.2.9.3 Identification of high level coexistence approaches (long-term basis) between PC5 transport for V2V services and DSRC/IEEE 802.11p services in the same channel

R1-164089 Co-channel of PC5 V2V with other techniques Huawei, HiSilicon
R1-164457 Co-channel coexistence between V2V and DSRC Qualcomm Incorporated
R1-164540 Discussion on coexisting LTE-V2V and IEEE802.11p on the same carrier LG Electronics
R1-164792 Interlaced transmissions for co-existence with DSRC Samsung
R1-165243 Detection Sequence in LTE-ITS Sidelink for Coexistence with IEEE 802.11p Ericsson

R1-165826 Way Forward on DSRC co-existence Samsung, ZTE, LG Electronics, Sony
R1-165830 WF on DSRC/LTE-based ITS Coexistence Ericsson, Huawei, HiSilicon

R1-165844 WF on DL broadcast enhancement for V2X Huawei, HiSilicon, Ericsson

Agreements:

- RAN1 believes that other radio access technologies and LTE-based ITS transmissions on sidelink can co-exist; some standardization and/or regulatory actions need to be taken in other bodies in order to enable this.
- The possible solutions identified by RAN1 for high level coexistence approaches (long-term basis) between PC5 transport for V2V services and DSRC/IEEE 802.11p services in the same channel are as follows:
  - Geo-location and database.
  - Time sharing between systems based on GNSS timing; this would require some modifications to DSRC.
  - Sensing-based vacate/switching approaches with or without transmission of a predetermined signal(s) (e.g. LTE-ITS preamble, SLSS)
    - Sensing with a predetermined signal(s) would require some modifications to DSRC.
  - RAN1 has not conducted any system-level evaluations for these solutions, although some link-level results have been provided for some solutions.
- RAN1 respectfully asks RAN to provide RAN1 findings to other relevant bodies.

LS containing the above to be sent to RAN plenary – Stefano (Ericsson) - R1-165494 - revisit on Friday.
R1-165494 [DRAFT] LS on high level coexistence approaches between PC5 transport for V2V services and DSRC/IEEE 802.11p services in the same channel Ericsson
Agreed in R1-166033

6.2.9.4 Others

R1-165270 Proposed TP for 36.885 Conclusions Ericsson
R1-165870 Proposal for SI conclusions LG

R1-165899 Way forward on V2X study conclusion LG Electronics, Huawei, HiSilicon, Samsung, Panasonic, Nokia, ASB, NTT DOCOMO, Ericsson

Agreements:

- The following text is agreed as
  - the conclusion on the feasibility of LTE-based V2X, and
  - the recommendation from RAN1.
- Email discussion is triggered to discuss how to recommend the solutions identified in other WGs.

Text:
The RAN WGs concluded that it is feasible to support transport for V2V, V2I/N and V2P services over Uu. The RAN WGs identified solutions to improve the latency, capacity, and reliability performance of LTE Uu interface and observed that UL enhancements to the SPS protocol and DL enhancement to multicast/broadcast are beneficial from performance perspective. It is recommended to support the following solutions identified in this TR for Uu-based V2X:

- Transmission using a single CP shorter than extended CP, with normal CP as the baseline, with necessary additional study
- HARQ feedback and retransmissions for SC-PTM and MBSFN, with necessary additional study
- Geo-information report from RRC_Connected UEs
  - No additional specification work is needed.
- [TBD on the solutions from other WGs]

The RAN WGs concluded that it is feasible to support V2I and V2P servicesover PC5. It is concluded that V2P services where P-UE sends V2X messages but not receives V2X messages is substantially more power efficient than V2P services where P-UE receives V2X messages from V-UEs. The RAN WGs identified that some changes to the PC5 interface would be beneficial in terms of power consumption and UE complexity in case of P2V transmissions. It is recommended to support following solutions identified in this TR for PC5-based V2X:

- Random resource selection for P-UEs potentially on the resource pool shared with V-UE transmissions, with additional study on sensing operation during a limited time for P-UEs
- [TBD on the solutions from other WGs]

6.2.10 Study on Latency reduction techniques

SID in RP-150465
Focus on this SI in 2Q 2016 will follow approved WF (RP-160650)

R1-165942 Chairman's Notes of Agenda Item 6.2.10 on Latency Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed with following updates

R1-165827 Offline session notes Ericsson
R1-165829 TP for conclusion of latency reduction SI Ericsson
R1-165855 TP for conclusion of latency reduction SI Ericsson
R1-165836 TP for latency reduction Ericsson
R1-165856 TR update Ericsson
R1-165828 [Draft] LS on TR update for latency reduction Ericsson
Agreed in R1-165913

6.2.10.1 Channel design for shortened TTI

Provide channel design including reference signals for s(E)PDCCH, sPDSCH, sPUSCH, sPUCCH. Provide recommendations on supported sTTI length(s).

R1-164160 Downink control singaling design for shorten TTI Intel Corporation
R1-164233 Design of sPUCCH for shortened TTI CATT
R1-164459 UL channel design for shortened TTI Qualcomm Incorporated
R1-164544 Discussion on sPUSCH design with TTI shortening LG Electronics
R1-164867 CQI feedback overhead reduction in short TTI Huawei, HiSilicon
R1-164923 Simultaneous Transmissions of UL Signals for Shortened TTI Operation Nokia, Alcatel-Lucent Shanghai Bell

R1-165549 Way forward on sTTI length Huawei, HiSilicon, Ericsson
Working assumption:

- It is recommended to support a design that is based on 2-symbol sTTI and 1-slot sTTI for sPDSCH/sPDCCH
- It is recommended to support a design that is based on 2-symbol sTTI, 4-symbol sTTI, and 1-slot sTTI for sPUCCH/sPUSCH
  - During the WI phase, down-selection is not precluded
- The working assumption is automatically confirmed by the end of Thursday if no significant issues are found
- Note: the supported sTTI lengths are not intended to impact discussion on additional subframe types in TDD.

Note: the above working assumption is already confirmed for FDD, and updated for TDD

R1-165544 Way Forward on sPUCCH design LG Electronics, Ericsson , Panasonic, NTT DOCOMO, Sharp, KDDI
Agreement:
- The following sPUCCH formats are recommended to be supported
  - One sPUCCH format for HARQ-ACK and/or SR feedback for a serving cell
  - sPUCCH format(s) for multiple HARQ-ACK bits, e.g. as in CA and frame structure type 2
    - The amount of sPUCCH formats to support is depending on the maximum identified payload size to support
    - sPUCCH format allows for multiplexing of HARQ-ACK and SR
    - FFS: sPUCCH format supports CSI feedback

R1-165550 WF on UL DMRS for sTTI Huawei, HiSilicon, Ericsson,Qualcomm
R1-165545 WF on DM-RS for sPUSCH LG Electronics, CATT, NTT DOCOMO, Samsung
Agreement:
- For DM-RS of sPUSCH, the followings are recommended to be supported:
  - For the case of 1-slot TTI length, reuse the current DM-RS
  - For the case of less than 1-slot TTI length, support DM-RS sharing/multiplexing of consecutive TTIs from one or multiple UEs
    - At least 2 contiguous TTIs can be shared/multiplexed. FFS on sharing /multiplexing of more than 2 contiguous TTIs
    - FFS on how to share/multiplex DM-RS (e.g., CDM, FDM, different BW between RS & data, and hybrid thereof)
    - FFS the DMRS position and whether it is indicated by eNB

R1-165523 sPDCCH Ericsson
R1-165631 Way forward on sPDCCH Ericsson, Nokia, Alcatel-Lucent Shanghai Bell, Mediatek, Sharp, Huawei, HiSilicon, CATT, CATR, Motorola Mobility, ZTE
Agreement:
- Confirm the working assumption
  - Working Assumption:
    - CRS-based sPDCCH is recommended to be supported
      - FFS whether CRS-based sPDCCH can be transmitted in the legacy PDCCH region
    - DMRS-based sPDCCH is recommended to be supported
    - Design of both CRS-based sPDCCH and DMRS-based sPDCCH will be studied further.
- From resource utilization perspective, sPDSCH assigned by a sPDCCH can be mapped to resources that are left unused by any sPDCCH
  - Details are for further study, e.g., FFS whether unused resources is RB or RE level

R1-165548 Way Forward on sPDCCH transmitted in sTTI and legacy PDCCH region ZTE, ZTE Microelectronic

R1-165522 Way forward on sPDSCH Ericsson, Huawei, HiSilicon, Panasonic
Agreement:
- For sPDSCH based on a CRS based transmission scheme the maximum number of supported layers is 4
- For sPDSCH based on a DM-RS based transmission scheme shall be down-selected among the following options
  - the maximum number of supported layers is 2
  - the maximum number of supported layers is 4
  - the maximum number of supported layers is 8
- FFS for sPDSCH based on a DM-RS based transmission scheme it is recommended to increased PRB bundling size compared to PDSCH for at least sTTI lengths shorter than 1-slot

R1-165547 Way forward on latency reduction for TDD ZTE, CMCC, Ericsson, CATT, Sharp, DoCoMo

R1-165551 Way Forward on TDD FS2 for latency reduction Huawei, HiSilicon, Panasonic, CATT, Qualcomm, Nokia, Alcatel-Lucent Shanghai Bell

R1-165892 WF on TDD latency reduction Huawei, HiSilicon, CMCC, Nokia, ASB, Panasonic, Ericsson, ZTE
Agreement:
- Regarding sTTI length:
  - Confirm the working assumption for FS1 FDD
  - Take the following agreement for FS2 TDD
    - It is recommended to support a design that is based on 1-slot sTTI for sPDSCH/sPDCCH/sPUSCH/sPUCCH for FS2 TDD in Rel-14

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- It is recommended to consider enhancements including other shorter sTTI duration(s), and additional DL-UL switching points/ additional subframe types for FS2 TDD latency reduction in Rel-15

R1-165546 WF on UCI transmission on sPUSCH LG Electronics, Ericsson, Intel, Nokia, Alcatel-Lucent Shanghai Bell, NTT DOCOMO, Sharp

Agreement:

- The following principles on sPUSCH are recommended to be supported:
  - UCI transmission on sPUSCH is supported
  - FFS UCI mapping rule, especially considering the impact of DM-RS design
  - FFS on which carrier to multiplex UCI on in case different sTTI lengths are used on different UL CA
  - Note:
    - The UCI herein refers to at least the ones for sTTI operations
    - FFS whether or not the UCI also includes the ones for legacy TTI operations

R1-164232 Design of sPDCCH for shortened TTI CATT
R1-164793 sPDCCH and sDCI design Samsung
R1-165237 On two-level DL control channel design for shorter TTI operation Nokia, Alcatel-Lucent Shanghai Bell
R1-164060 DCI design for short TTI Huawei, HiSilicon
R1-165771

Conclusion:

- Further discussion during the WI phase (if WI is approved) regarding the single-level DCI vs. two-level DCI considering aspects such as overhead, complexity, potential scheduling restriction, search space design, the corresponding performance, impact of different TTI lengths (if any), etc.
  - Note: this conclusion is not be included in the TR

R1-164058 Views on TTI length Huawei, HiSilicon
R1-164059 sPDCCH design for short TTI Huawei, HiSilicon
R1-164061 PUCCH design for short TTI Huawei, HiSilicon
R1-164062 Discussion on DL RS for short TTI Huawei, HiSilicon
R1-164063 Discussion on UL RS for short TTI Huawei, HiSilicon
R1-164065 Discussion on CSI feedback for short TTI Huawei, HiSilicon
R1-164068 The co-existence consideration of legacy TTI and sTTI in one carrier Huawei, HiSilicon
R1-164115 Reducing UL RS overhead for sPUSCH Mitsubishi Electric
R1-164161 Consideration on S-PDCCH design for latency reduction Intel Corporation
R1-164162 UL design aspects of TTI shortening Intel Corporation Intel Corporation
R1-164234 Design of sPUSCH DMRS CATT
R1-164235 Discussion on the simultaneous transmissions of normal TTI and sTTI CATT
R1-164458 DL channel design for shortened TTI Qualcomm Incorporated
R1-164487 Details of Two-stage downlink control channel NEC
R1-164541 Discussion on candidate length for sTTI LG Electronics
R1-164542 Discussions on DCI and sPDCCH for latency reduction LG Electronics
R1-164543 Discussions on sPDSCH for latency reduction LG Electronics
R1-164545 Discussion on sPUCCH for HARQ-ACK in latency reduction LG Electronics
R1-164546 Discussion on sPUCCH for CSI in latency reduction LG Electronics
R1-164581 Discussion on DL control for shortened TTI Spreadtrum Communications
R1-164582 Considerations on shortened TTI transmission within MBSFN subframe Spreadtrum Communications
R1-164583 sTTI schedule impact due to MBSFN or ABS subframe Spreadtrum Communications
R1-164639 Discussion on sPDCCH for shortened TTI ZTE
R1-164640 PUCCH design and evaluation for shortened TTI ZTE
R1-164642 Study on PDSCH transmission in shortened TTI ZTE
R1-164643 Study on PUSCH transmission in shortened TTI ZTE
R1-164649 Design of DL channels for shortened TTI Lenovo (Beijing) Ltd
R1-164650 Design of UL channels for shortened TTI Lenovo (Beijing) Ltd
R1-164663 Discussion on control signaling design for reduced TTI HTC
R1-164794 sPUCCH design Samsung
R1-164795 Discussion on sPDSCH Samsung
R1-164796 Discussion on sPUSCH Samsung
R1-164820 PUSCH design for short TTI Huawei, HiSilicon
R1-164821 PDSCH design for short TTI Huawei, HiSilicon
R1-164886 Discussion on low latency control channel design CMCC
R1-164909 Discussion on reference signal design for shortened TTI Panasonic
R1-164910 Discussion on multiplexing between sTTI and TTI in the same subframe Panasonic

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R1-164911	Discussion on single level DCI and two-level DCI	Panasonic
R1-164914	UL aspect of shortened TTI	Panasonic
R1-164922	sPUCCH Design for Shortened TTI	Nokia, Alcatel-Lucent Shanghai Bell
R1-164945	On supported Shorter TTI lengths and its configurability	Nokia, Alcatel-Lucent Shanghai Bell
R1-164946	On simultaneous unicast PDSCH and sPDSCH operation	Nokia, Alcatel-Lucent Shanghai Bell
R1-164999	Shortened TTI for DL transmissions	Sharp, MTI
R1-165001	Channel design of shortened PUCCH	Sharp
R1-165049	Consideration on sPDCCH Design	InterDigital
R1-165050	Consideration on sPDSCH Design	InterDigital
R1-165051	Consideration on sPUCCH Design	InterDigital
R1-165052	Consideration on sPUSCH Design	InterDigital
R1-165069	Discussion on length of shortened TTI	China Telecommunications
R1-165109	Shortened TTI Design	Motorola Mobility
R1-165110	Multiplexing of Regular TTI and shortened TTI	Motorola Mobility
R1-165122	Discussion on latency reduction with short TTIs	Mediatek
R1-165123	Control channel design for latency reduction	Mediatek
R1-165209	sPDCCH for shortened TTI	NTT DOCOMO, INC.
R1-165210	sPDSCH for shortened TTI	NTT DOCOMO, INC.
R1-165211	sPUSCH for shortened TTI	NTT DOCOMO, INC.
R1-165212	sPUCCH for shortened TTI	NTT DOCOMO, INC.
R1-165213	Views on sTTI length	NTT DOCOMO, INC.
R1-165236	On DL control channel design for shorter TTI operation	Nokia, Alcatel-Lucent Shanghai Bell
R1-165249	Impact of shortened TTI on uplink transmission	ASUSTEK COMPUTER (SHANGHAI)
R1-165267	Discussion on PUCCH design for shortened TTI	KDDI Corporation
R1-165290	Discussions on the channel design for latency reduction	CATR
R1-165292	Physical design aspects of sPDCCH	Ericsson
R1-165293	sPDCCH search space design	Ericsson
R1-165294	DCI for sTTI scheduling	Ericsson
R1-165295	Physical design aspects of sPDSCH	Ericsson
R1-165296	Physical design aspects of sPUSCH	Ericsson
R1-165297	Physical design aspects of sPUCCH	Ericsson
R1-165298	Short TTI operation in FS2	Ericsson
R1-165299	On the operation with different TTI lengths	Ericsson
R1-165310	Discussion on short PUSCH design	KT Corp.

6.2.10.2 Processing time reduction and related procedures

Provide targets on how much the processing time/maximum TA can be reduced

R1-164885	Discussion on latency reduction for TDD	CMCC
R1-164638	Latency reduction solutions for TDD	ZTE
R1-164797	Discussion on processing time for TTI shortening	Samsung
R1-165300	On reduced processing time for short TTI	Ericsson

R1-165524	Way forward on processing timing reduction for sTTI	Ericsson
R1-165707	Way forward on processing timing reduction for sTTI	Ericsson

Agreement:

- It is recommended to reduce the maximum TA for short TTI operation with processing time reduction compared to Rel-13
  - Details are FFS
- A single minimum delay between UL grant and UL data and between DL data and DL HARQ feedback is recommended to be supported for a given sTTI length

R1-165854 Way forward on processing timing reduction for sTTI Ericsson

Agreements:

- The minimum timing for UL grant to UL data and for DL data to DL HARQ is n + k sTTI for short TTI operation;
  - Processing time >= the legacy processing time linearly downscaled with TTI length
    - 4 <= k <= 8
  - FFS whether or not to support processing time is lower than the legacy processing time linearly downscaled with TTI length for at least slot based TTI
    - k < 4 for slot based TTI.
  - Note that sTTI refers to

    - sPUSCH sTTI for the UL grant to UL data timing
    - sPDSCH sTTI for the DL data to DL HARQ feedback timing
  - FFS how to the handle the minimum timing for the case when DL sTTI and UL sTTI have different lengths
- Further study whether or not the eNB would indicate an additional parameter m (Note: the value may be dependent on the discussion on the max TA), resulting in a timing of n + k + m sTTI
  - FFS: semi-static or dynamic configuration of m, if introduced
- The minimum timing for UL grant to UL data and for DL data to DL HARQ is n + k TTI for subframe-long TTI operation and short TTI capable UEs.
  - k = 4 is supported
  - Further study whether a reduced minimum timing is possible, e.g. k = 2, k = 3, and if a reduced maximum TBS is needed to achieve this
- Note: CQI feedback enhancements for short TTI and legacy TTI are not precluded

R1-164064 Discussion on UL scheduling timing for short TTI Huawei, HiSilicon
R1-164066 Discussion on DL HARQ timing for short TTI Huawei, HiSilicon
R1-164067 Processing time reduction for short TTI Huawei, HiSilicon
R1-164163 On the processing time reduction and maximum TA limitations Intel Corporation
R1-164236 TDD system design for shortened TTI and related procedures for latency reduction CATT
R1-164460 Processing time reduction and related procedures for DL Qualcomm Incorporated
R1-164461 Processing time reduction and related procedures for UL Qualcomm Incorporated
R1-164462 TDD-specific processing time reduction and related procedures Qualcomm Incorporated
R1-164470 Discussion on TTI shortening Guangdong OPPO Mobile Telecom.
R1-164547 Processing time reduction for latency reduction LG Electronics
R1-164641 Processing time reduction and related procedures ZTE
R1-164912 Evaluation results on processing time reduction in physical layer Panasonic
R1-164947 Legacy TTI processing time considerations for supporting latency reduction Nokia, Alcatel-Lucent Shanghai Bell
R1-164948 sTTI processing time considerations for supporting latency reduction Nokia, Alcatel-Lucent Shanghai Bell
R1-165214 Views on processing time reduction and related procedures NTT DOCOMO, INC.
R1-165269 Discussion on HARQ Process for Slot-based TTI ASUSTEK COMPUTER (SHANGHAI)

6.2.10.3 Remaining evaluation results

Remaining aspects of system and link evaluation results, e.g. FS2 related aspects

R1-164164 Link level evaluation for PDSCH in a short TTI Intel Corporation
R1-164237 TDD system performance evaluation of latency reduction CATT
R1-164238 System performance evaluation for dynamic control channel overhead CATT
R1-164463 Updated link-level evaluation of TTI shortening in DL Qualcomm Incorporated
R1-164464 Updated link-level evaluation of TTI shortening in UL Qualcomm Incorporated
R1-164465 Updated system level evaluations Qualcomm Incorporated
R1-164548 System-level simulation results for TDD scenario with latency reduction LG Electronics
R1-164549 Further link level evaluation of sPUSCH for shortened TTI LG Electronics
R1-164637 System-level performance evaluation for TDD ZTE
R1-164823 Summary of performance evaluation for latency reduction in TDD Huawei, HiSilicon
R1-164824 Performance evaluation for latency reduction based on frame structure set 3 Huawei, HiSilicon
R1-164825 Performance evaluation for latency reduction based on enhanced frame structure set 1 Huawei, HiSilicon
R1-164826 Performance evaluation for latency reduction based on enhanced frame structure set 2 Huawei, HiSilicon
R1-165076 Link level simulation results for S-PDCCH Intel Corporation
R1-165077 System level simulations with FTP model 3 Intel Corporation
R1-165238 System level study on processing time reduction and TCP parametrization impact Nokia, Alcatel-Lucent Shanghai Bell
R1-165301 Additional system level results for short TTI and downlink traffic Ericsson
R1-165302 Additional system level results for short TTI and uplink traffic Ericsson
R1-165303 Additional system level results for short TTI with different processing times Ericsson
R1-165304 Additional link results for sPDSCH Ericsson
R1-165305 Additional link results for sPUCCH Ericsson

R1-165518 Updates to Link Level results Ericsson
Conclusion:
- The TP is endorsed, but without the parts concerning the puncturing performance

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R1-165519 Updates to Link Level observations Ericsson
Conclusion:

- The TP is endorsed, except the following:
  - Removing the following:

    One source showed that puncturing of an PDSCH within a subframe long TTI by an short TTI significantly degrades the BLER performance and at ~~16QAM or~~ higher modulation orders makes the PDSCH undecodable. Whether there are any enhancements to PDSCH reception in this case that would allow better reception performance has not been studied.

  - Update the last sentence in the sPUCCH section with the following:
    - For larger payload sizes e.g. 5 to 40 bits, can achieve tolerable performance with a longer sTTI length. Note that there is some coverage impact with shorter TTI lengths with large payload sizes.

R1-165520 Updates to System level results Ericsson
Conclusion:

- The TP is endorsed
  - Note: further update is necessary based on the new results available till midnight Tuesday

R1-165521 Updates to System level observations Ericsson
Conclusion:

- The TP is endorsed, with the following updates in the last paragraph
  - Updating:
    - At least shown by two sources, under a given TDD UL/DL subframe configuration, introducing additional subframe types for a new UE can further reduce the U-plane latency for TDD compared to the case without introducing additional subframe types in the evaluated scenarios.
- Including the impact analysis not limited to additional subframes types – Laetitia (Ericsson)
  - Detailed wording to be worked on offline
- Further discussion offline whether or not to further update the following sentences:
  - Two sources show that the performance of 14OS TTI length with reduced processing time (i.e. with reduced HARQ RTT and UL access delay) comes close to the one of slot based TTI length. However, source 4 shows that if 14OS TTI follows the same TBS assumption as 7OS TTI length, gains of 14OS TTI length with reduced processing time are smaller than the ones of other short TTI lengths.
  - Three sources (R1-16454~~30~~, R1-164637, R1-164823) show that in the most favourable~~ite~~ situation for TTI shortening, introducing short TTI in existing TDD UL/DL configuration without additional subframe type can lead to large user perceived throughput~~performance~~ improvement. ~~and gains are larger with shorter TTI lengths.~~ Four sources (R1-164823, R1-164237, R1-164637, R1-164548) show that in the most favourable~~ite~~ situation for TTI shortening , introducing short TTI with additional subframe type within existing UL/DL configuration can lead to ~~much~~ improved user perceived throughput compared to introducing short TTI without additional subframe type within existing UL/DL configurations, especially for short TTI length as 2OS. One source (R1-164548) shows that significant performance loss in 5th percentile user throughput with shorter TTI length like 2OS both with and without additional subframe type.

R1-165632 TP for inclusion of evaluation assumptions for FS2 Ericsson
Conclusion:

- The TP in R1-165632 is endorsed

R1-165705 Updates to System level results Ericsson
Conclusion:

- The TP in R1-165705 is endorsed

R1-165706 Updates to System level observations Ericsson
Conclusion:

- The TP is endorsed, except the following update:
  - From "There is difficulty to schedule legacy UEs in the additional subframes and therefore the performance of legacy UEs is degraded. How much the degradation for legacy UEs is has not been evaluated in the study item. "
  - To "The performance of legacy UEs is degraded with the introduction of additional subframe type. It has not been evaluated during the SI on how much degradation for legacy UEs. "

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6.2.10.4 Others

R1-164069	Discussion on enhanced frame structure type 2 for latency reduction	Huawei, HiSilicon
R1-164070	Discussion on U-plane latency for TDD	Huawei, HiSilicon
R1-164584	HARQ feedback for sTTI scheduling	Spreadtrum Communications
R1-164798	TDD-specific issues on TTI shortening	Samsung
R1-164913	Additional subframe type for TDD	Panasonic
R1-164924	Considerations on shorter TTI for TDD duplex mode	Nokia, Alcatel-Lucent Shanghai Bell
R1-165003	Short TTI and processing time reduction for TDD	Sharp, MTI
R1-165215	Further Discussion about TDD Frame Structure for Latency Reduction	NTT DOCOMO, INC.
R1-165256	Latency Reduction for FS2 with 1-ms TTI	Nokia, Alcatel-Lucent Shanghai Bell

6.2.11 Study on Further enhancements to Coordinated Multi-Point Operation

SID in RP-160665

R1-165943 Chairman's Notes of Agenda Item 6.2.11 on eCOMP Session Chairman (Qualcomm Inc.)
Contents incorporated below
Endorsed

R1-164165 Work plan for FeCoMP study item Intel Corporation, ZTE
R1-164298 TR Skeleton for Study on FeCoMP ZTE
Conclusion:

- The TR skeleton in R1-164298 is endorsed, with the following updates:
  - Section 5.1: Evaluation Scenarios for Non-coherent Joint Transmission
  - Section 6.1: Potential Enhancements for Non-coherent Joint Transmission

R1-164084 Overview on further enhancements to Coordinated Multi-Point Operation Huawei, HiSilicon
R1-164299 Overview on FeCoMP ZTE

6.2.11.1 Deployment scenarios and system-level evaluation assumptions

Consider the existing dense deployment scenarios and evaluation assumptions as starting point. The priority at RAN1#85 will be given to the scenarios and evaluation assumptions.

R1-164167 Evaluation assumptions for FeCoMP evaluations Intel Corporation
R1-164300 Deployment scenarios and evaluation assumptions for JT ZTE
R1-164974 Scenarios for feCoMP SoftBank Corp.

R1-165845 Way Forward on scenarios for FeCoMP evaluations Intel, ZTE, ZTE Microelectornic, Softbank, KT Corporation, Huawei, HiSilicon, LGE, CATT, Xinwei, Ericsson, Samsung, Nokia, ASB

R1-165852 Way Forward on Evaluation Assumptions for FeCoMP ZTE, ZTE Microelectronics, Intel, Ericsson, Nokia, ASB, Huawei, HiSilicon, LGE, Samsung, CATT, ASTRI, Xinwei, KT Corporation
Agreement:

- The WF in R1-165852 is agreed, with the following updates:
  - Macro cell layer TP:
    (8,4,2), (8,8,2) optional, (8,1,2) ~~optional~~
  - Small cell layer TP:
    M=1 (FFS whether or not additionally have M=4 as optional), N=1, 2 or 4 (optional), P = 2
  - Baseline 3TPs~~, other values are not precluded and if used should be reported.~~ If a different value is used, it should be indicated.
  - Non full buffer FTP traffic model 1, S = 0.1Mbytes (optional) or 0.5Mbytes
  - 2Rx, 4Rx (only for non-coherent JT), $0^0/90^0$ polarization slants, 0.5 wavelength spacing
  - CS/CB for FD-MIMO: 2 or more ports per NZP CSI-RS resource ~~(total number of CSI-RS ports up to 16)~~
  - Baseline scheme:
    - ~~Option 1: DPS/DPB for JT, Single point for CS/CB~~
    - ~~Option 2: Rel-11 CoMP and non-CoMP Rel-13 FD-MIMO~~
    - ~~Option 3:~~ Provided by each company for now. Further discussion to finalize a baseline scheme till RAN1#86

R1-165851 Way Forward on Prioritization of Scenarios for FeCoMP ZTE, ZTE Microelectronics, Intel, ASTRI

R1-164085 Discussion on simulation scenarios and methodology for FeCoMP Huawei, HiSilicon

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R1-164166 Scenarios for FeCoMP evaluations Intel Corporation
R1-164239 Discussion on scenarios and evaluation assumptions for CoMP enhancement CATT
R1-164301 Deployment scenarios and evaluation assumptions for CS/CB ZTE
R1-164342 Considerations of FeCoMP deployment scenarios Nokia, Alcatel-Lucent Shanghai Bell
R1-164799 Deployment scenarios and system-level evaluation assumptions Samsung
R1-165103 feCoMP Scenarios and Evaluation Ericsson

6.2.11.2 *Potential enhancements for non-coherent joint transmission*

R1-164086 Potential enhancement for FeCoMP with ideal backhaul links Huawei, HiSilicon
R1-164087 Discussion on FeCoMP with non-ideal backhaul links Huawei, HiSilicon
R1-164168 CSI feedback enhancements for non coherent JT Intel Corporation
R1-164169 Control signalling enhancements for non coherent JT Intel Corporation
R1-164170 Initial evaluation results for non coherent JT Intel Corporation
R1-164240 Enhancement for non-coherent joint transmission CATT
R1-164302 Potential Enhancements for Joint Transmission ZTE
R1-164303 QCL Issues of Joint Transmission ZTE, ASTRI
R1-164343 Overview of non-coherent joint transmission for FeCoMP Nokia, Alcatel-Lucent Shanghai Bell
R1-164550 Discussion on enhancements for non-coherent JT LG Electronics
R1-164800 Discussion on non-coherent joint transmission for FeCoMP Samsung

R1-165876 WF on non-coherent JT schemes for FeCoMP Huawei, HiSilicon, Intel, SoftBank Corp, ZTE, CATT

6.2.11.3 *Potential enhancements for coordinated scheduling/beamforming with FD-MIMO*

R1-164088 Discussion on CSI measurement and feedback for FeCoMP Huawei, HiSilicon
R1-164171 Enhancements for CS/CB CoMP Intel Corporation
R1-164241 Coordinated beamforming with FD-MIMO CATT
R1-164304 Using FD-MIMO framework for CS/CB ZTE
R1-164344 Overview of FD-MIMO based CSCB transmission Nokia, Alcatel-Lucent Shanghai Bell
R1-164551 Discussion on enhancements for CS/CB with FD-MIMO LG Electronics
R1-164801 Potential enhancement for coordinated beamforming with FD-MIMO Samsung
R1-165104 feCoMP Motivations and Techniques Ericsson

6.2.11.4 *Others*

R1-164489 Enhancements to Coordinated Multi-point Operation: Impact of interference averaging NEC

7 NR

7.1 *Study on New Radio Access Technology - SID in* RP-160671

R1-165216 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO, INC.
The document was presented by Kazuaki Takeda from NTT DOCOMO.
Decision: The document is endorsed as v0.2.0.

Wednesday
R1-165804 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO
The document was presented by Kazuaki Takeda from NTT DOCOMO.
Discussion: Huawei, Qualcomm requested more time for detailed review.
Decision: The document is noted. Continue offline discussion until Thursday –(NTT DOCOMO)

R1-165720 Draft Reply LS on Parameters for WP5D sharing and compatibility studies NTT DOCOMO
Decision: The document is noted. Continue offline discussion about the notes – (NTT DOCOMO)
R1-165805 Draft Reply LS on Parameters for WP5D sharing and compatibility studies NTT DOCOMO
Decision: The document is noted and final LS is agreed in R1-165820.

Thursday
R1-165804 Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO
Decision: The document is noted. Further revised in:

R1-165882 **Draft TR 38.802 Study on New Radio (NR) Access Technology - Physical Layer Aspects NTT DOCOMO**
Discussion: Huawei → can the meaning of "baseline" used in multiple instances through the TR be clarified? Replaced by "is supported" may be better
DOCOMO: agreed – Terminology "baseline" will be updated in a later version
Decision: The document is noted and endorsed as v0.0.3 in R1-165889, with following update in Section 6.1:
The downlink transmission scheme is based on OFDM ~~using a cyclic prefix.~~

Not treated.
R1-165170 Workplan for Study on Study on New Radio Access Technology NTT DOCOMO, INC.

7.1.1 Forward compatibility for new radio interface

Solutions how to achieve forward compatibility with Phase II specification and beyond.

R1-164046 **Forward compatibility consideration on reference signals and control information/channels Huawei, HiSilicon**
The document was presented by Zukang Shen from Huawei.
- *Proposal 1: The reference signal for cell identification and coarse time/frequency synchronization in NR is not in a fixed frequency location within a carrier.*
- *Proposal 2: A minimum bandwidth shall be defined for the reference signal for RRM measurement in NR. Consider to derive the time/frequency location of the reference signal for RRM measurement based on the reference signal for cell identification and coarse time/frequency synchronization.*
- *Proposal 3: NR shall support orthogonal reference signals among different links (such as downlink, uplink, sidelink, backhaul link).*

Decision: The document is noted.

R1-164242 **NR system design for forward compatibility CATT**
The document was presented by Fang Chen Cheng from CATT.
- *Proposal 1: For forward compatibility of support low cost mMTC, the NR system needs to support the operations of narrowband carrier standalone or embedded in a wideband carrier, single transceiver chain and communication with passive devices.*
- *Proposal 2: For forward compatibility of massive MTC power efficiency, the NR system should support on-demand wakeup for the sleeping device and communication with passive devices.*
- *Proposal 3: The channel coding scheme with extremely high coding gain should be supported for URLLC applications.*
- *Proposal 4: The NR system design should target common design of control channels and reference signals in the frame structure for downlink, uplink and sidelink. The control channel design should support both central and distributed resource allocation and coordination.*
- *Proposal 5: The NR system should support opportunistic access for the operation on dedicated and shared spectrum.*

Decision: The document is noted.

R1-164633 **On forward compatibility Ericsson**
The document was presented by Stefan Parkvall from Ericsson and proposes the following to improve future compatibility:
- Avoid fixed timing relations across subframe borders
- Self-contained transmission where data (and control) transmissions have, e.g., their own reference signals.
- Avoid tying multiple quantities to a single underlying quantity unless there is a clear motivation.

Decision: The document is noted.

R1-165367 **On forward compatibility for NR China Unicom**
The document was presented by Xiao Han from China Unicom.
Observation 1: the blank resources design should enable the Phase 1 UEs successfully receive and decode the UE-specific channels transmitted on adjacent time and frequency resources.
Observation 2: the cell-specific RS should be minimized on resources and configurable for usage scenarios and numerologies and necessary cell-specific RS should be supported.
Observation 3: single TDM and FDM solutions for multiplexing may not sufficient satisfy NR requirements.
Decision: The document is noted.

R1-164552 **Forward compatibility support design of NR LG Electronics**
The document was presented by Yunjung Yi from LGE.
- *Proposal 1: NR design should minimize (semi-)statically configured signal/channels but synchronization signals and system information in the very initial access state may be (semi-) statically and periodically transmitted.*
- *Proposal 2: Flexible and dynamic TDD operation should be enabled in consideration of ICI in NR.*

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- *Proposal 3: Flexible HARQ timing for both DL and UL should be designed in consideration of UE processing capability and latency requirements of NR.*

Decision: The document is noted.

R1-164292 On forward compatibility for new radio interface ZTE

The document was presented by Ruyue Li from ZTE.

- *Proposal 1: The number of symbols per 1 ms is 2m, where m is an integer, since it allows smooth multiplexing of future services and use cases.*
- *Proposal 2: The design of NR numerology and frame structure should prioritize forward compatibility, in order to ensure smooth evolution to accommodate future services and use cases. Within one carrier of a network, numerology adaptation based on changing the number of symbols per subframe is preferred to scaling of subcarrier spacing, since it ensures better forward compatibility and reduces overhead.*
- *Proposal 3: Regarding reference signal design, we propose the following design principles:*
  - *Avoid always-on reference signals*
  - *Avoid periodic reference signals in a non-standalone system*
  - *Use aperiodic reference signals or configurable multi-shot reference signals*
  - *Granularity and overhead of reference signals should be flexibly configured depending on the different requirements of CSI measurement*
  - *Support multi-level CSI-RS with different configurable granularities*
- *Proposal 4: Avoid unnecessary periodic system information. Identify the fundamental system information for UE to access network. The fundamental system information should adapt to different use cases/scenarios.*
- *Proposal 5: Regarding control channel design, we propose the following design principles:*
  - Design of downlink control channel should be flexible to adapt to different application.
  - Multi-level downlink control channel structure should be considered in NR.
- *Proposal 6: Support multi-component and multi-level design in MIMO CSI feedback framework in NR*

Decision: The document is noted.

R1-165603 WF on NR forward compatibility Huawei, HiSilicon

The document was presented by Zukang Shen from Huawei.

- Forward compatibility of NR shall ensure smooth introduction of future services and features with no impact on the access of earlier services and UEs
  - Multiplexing different numerologies within a same NR carrier is supported
  - Reference signal for synchronization is not in a fixed frequency location within a carrier.
  - Transmission of system information is not in a fixed frequency location within a carrier
  - Avoid tying multiple parameters to a same parameter and rely more UE specific parameters as much as possible
  - Common design (e.g. waveform) shall be aimed for various link directions in NR, e.g. downlink, uplink, sidelink, backhaul link

Decision: The document is noted, further revised in R1-165628 as follows:

- Forward compatibility of NR shall ensure smooth introduction of future services and features with no impact on the access of earlier services and UEs
  - Multiplexing different numerologies within a same NR carrier bandwidth (from the network perspective) is supported
  - Reference signal for synchronization and transmission of MIB is not in a fixed frequency location within a NR carrier bandwidth (from the network perspective).
    - The frequency location of MIB is derived from the reference signal for synchronization (e.g. the same frequency location)
  - Avoid tying multiple parameters to a same parameter and rely more UE specific parameters as much as possible
  - Common design should be aimed for various link directions in NR, e.g. downlink, uplink, sidelink, backhaul link

Agreements:

- Forward compatibility of NR shall ensure smooth introduction of future services and features with no impact on the access of earlier services and UEs
  - Multiplexing different numerologies within a same NR carrier bandwidth (from the network perspective) is supported
    - FDM and/or TDM multiplexing can be considered

Possible agreements:

- Reference signal for synchronization and transmission of MIB is not in a fixed frequency location within a NR carrier bandwidth (from the network perspective).

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- The frequency location of MIB is derived from the reference signal for synchronization (e.g. the same frequency location)
- Avoid tying multiple parameters to a same parameter and rely more UE specific parameters as much as possible
- Common design should be aimed for various link directions in NR, e.g. downlink, uplink, sidelink, backhaul link

R1-165607 WF on implicit dependencies assumptions InterDigital, Ericsson, Huawei, HiSilicon

The document was presented by Paul Marinier from InterDigital.

- Implicit (i.e. non-configurable) dependencies between transmissions that exist in LTE design are not by default assumed to be introduced in NR design.
- An identity parameter may tie signals for search/synchronization (e.g. PSS/SSS) to the broadcast transmission of essential system information (e.g. MIB)
  - Name of identity parameter TBD (e.g. cell ID, hypercell ID, system ID)
  - Other dependencies to this identity parameter can be introduced if considered beneficial taking into account forward compatibility, signalling overhead and complexity

Decision: The document is noted.

Possible agreements:

- For NR design, implicit (i.e. non-configurable) dependencies can be introduced if considered beneficial taking into account forward compatibility, signalling overhead and complexity
  - It is not assumed by default that implicit dependencies that exist in LTE design are introduced in NR design

Possible agreements:

- An identity parameter ties signals for search/synchronization to the broadcast transmission of essential system information
  - Name of identity parameter TBD (e.g. cell ID, hypercell ID, system ID)
  - Other dependencies to this identity parameter can be introduced if considered beneficial taking into account forward compatibility, signalling overhead and complexity

Agreements:

- Timing between data transmission and corresponding HARQ A/N is indicated explicitly
  - FFS if implicit indication is supported in some cases
- Essential system information (MIB) should be decodable based on an identity parameter used for generation of search/synchronization signal (e.g. PSS/SSS)
  - Name of identity parameter TBD (e.g. cell ID, hypercell ID, system ID)
  - Other dependencies to this identity parameter are FFS

Wednesday

R1-164674 Channel bandwidth consideration for forward compatibility Qualcomm Incorporated

The document was presented by Tingfang Ji from Qualcomm.

- Proposal 1: NR UE should be allowed to support a subset of NR channel bandwidth.
- Proposal 2: NR channel bandwidth should be defined to allow efficient unlicensed spectrum access.
- Proposal 3: NR UEs should be tested for a limited set of channel bandwidth. Additional Tx/Rx requirements for service multiplexing in frequency domain should be studied for baseband filtering.

Decision: The document is noted.

R1-165806 WF on Supporting different Numerologies in a NR carrier LG Electronics, Huawei, HiSilicon

- It is supported that a NR carrier can be divided into multiple Frequency Resource Groups (FRGs) in frequency domain
  - Different FRGs can have different numerologies
  - Each FRG may have independent synchronization signal(s)
  - Multiple FRGs may share the same synchronization signal(s)
  - Further consider DC subcarrier aspects in a NR carrier comprising multiple FRGs

Decision: The document is noted. Continue offline.

Thursday

R1-165837 WF on Supporting different Numerologies in a NR carrier LG Electronics, Huawei, HiSilicon, Panasonic

Decision: The document is noted.

Possible agreements:

- Contiguous frequency resources using one numerology in a NR carrier is called frequency resource group (FRG)
  - A numerology is defined at least by CP duration and subcarrier spacing
  - One numerology is applied in FRG over T time duration

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- FFS on details of T

– Multiple FRGs in a NR carrier with different numerologies is supported
– Multiple FRGs in discontinuous frequency resources in a NR carrier can use the same or different numerology
– FFS
  - sizes of FRG
  - whether FRG (e.g., size of FRG and T) can change dynamically or semi-statically.
  - whether different FRGs can overlap or not
  - whether/how to handle DC subcarrier aspects in a NR carrier comprising multiple FRGs
– FFS: NR supports the following
  - Each FRG has its own synchronization signal(s)
  - Multiple FRGs share the same synchronization signal(s)

Continue offline discussion until Friday –(LGE)

Friday

R1-166008 WF on Supporting different Numerologies in a NR carrier LG Electronics, Huawei, HiSilicon, Panasonic, Ericsson

Decision: The document is noted and modified as follows:

Agreements:

- For a NR carrier (from network perspective) using multiple numerologies, at least the following is for further study
  - multiple frequency/time portions using different numerologies share a synchronization signal
    - Note: The synchronization signal refers to the signal itself and the time-frequency resource used to transmit the synchronization signal

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R1-165873 Way Forward on fixed DL physical resource for dynamic operation in NR LG Electronics, Qualcomm, Panasonic, NTT Docomo

- A UE may assume NR has downlink reference signal(s) with a certain periodicity/duration in time at least for the purpose of synchronization.
  – FFS: necessary frequency domain resource for the reference signal(s)
  – FFS: necessary time domain periodicity/duration for the reference signal(s)
  – FFS: whether the UE may assume the reference signal(s) is transmitted with the periodicity irrespective of the UE condition (e.g., already/yet synchronized with LTE/NR)
  – FFS: whether UE may assume a common numerology for this signal
- Downlink physical resources that composes the above downlink reference signal(s) may also comprise downlink reference signal(s) for the purpose of RRM measurement.
  – FFS : the downlink physical resources are contiguous in time
  – FFS : the downlink physical resources are contiguous in frequency
- FFS: other signal(s)/channel(s) necessary in the downlink physical resource.
- Physical resources except for the above downlink physical resources are flexibly utilized either as DL or UL or SL

Decision: The document is noted. Continue offline discussion until Friday – (LGE)

Friday: no progress.

R1-165674 Way forward on forward compatibility for waveform evolution Spreadtrum, CATR, CMCC, Cohere, Deutsche Telekom, InterDigital, Orange, Sony, Telstra, Telefonica, ZTE

- Forward compatibility for waveform evolution should be ensured in system framework design.
  - Downlink, uplink and sidelink share the same framework of physical layer processing.

Discussion: Also supported by Fraunhofer HHI, NTU, Panasonic
Concern from a number of companies
Spreadtrum stressed how forward compatibility can be ensured?
Spreadtrum would like to see it included in the TR
Chair: TP to TR will come at a later stage, let's discuss technical solutions before trying to capture anything

Decision: The document is noted.

Not treated.

R1-163982 Forward compatibility for NR Samsung
R1-164047 General consideration on forward compatibility for new radio interface Huawei, HiSilicon
R1-164172 Forward compatible and low overhead structure for NR Intel Corporation
R1-164387 Forward compatibility considerations on physical layer procedures Huawei, HiSilicon
R1-164471 On forward compatibility of NR Guangdong OPPO Mobile Telecom.
R1-164585 Forward compatibility for waveform evolution Spreadtrum Communications

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R1-164651	Forward compatibility for new radio interface	Lenovo (Beijing) Ltd
R1-164654	Consideration on forward compatibility for NR	Sony
R1-164664	Framework for forward compatible NR design	INTERDIGITAL COMMUNICATIONS
R1-164931	Discussion on Reference Signal Design	ITRI
R1-165160	Discussion on Forward Compatible System Design for NR	MediaTek Inc.
R1-165171	Forward compatibility for NR	NTT DOCOMO, INC.
R1-165172	Forward compatibility related to mMTC and URLLC	NTT DOCOMO, INC.
R1-165356	On the forward compatibility of new radio	Nokia, Alcatel-Lucent Shanghai Bell
R1-166002	WF on synchronization for NR forward compatibility	LG Electronics, Panasonic

7.1.2 Remaining issues on evaluation assumptions for new radio interface

R1-163984 Discussion on phase noise modeling Samsung

- *Proposal 1: Use multi-pole/zero model with configurable parameters such as PSD0 and multiple pole/zero frequencies for practical phase noise performance evaluations.*
- *Proposal 2: Study how to decide the model parameters.*
- *Observation 1: Discussion on the relationship between OFDM subcarrier spacing and phase noise is effective only when the CPE of phase noise is compensated properly.*
- *Observation 2: Considering phase noise, large subcarrier spacing can help to enhance EVM performance when large bandwidth up to a few GHz needs to be supported in higher frequencies.*
- *Observation 3: For higher frequencies, the $f_0 * 2^n$ subcarrier spacing set shows too big EVM performance gap between adjacent subcarrier spacing values considering phase noise. On the other hand, the $f_0 * 2^n * 5^m$ subcarrier spacing set with finite integers such that n=0,1,2,3,4,5,6,7,8 and m=0,1,2 seems to be good enough to support large bandwidth up to a few GHz in viewpoint of phase noise impacts.*

Decision: The document is noted.

R1-165944 Chairman's Notes of Agenda Item 7.1.2 on NR eval_assumptions Session Chairman (Nokia, Qualcomm Inc.)

The document was presented by Matthew Baker from Nokia and provides the outcomes of the session.
Decision: The document is endorsed. Contents incorporated below.

R1-165482 Remaining issues on evaluation assumptions NTT Docomo
Decision: The document is noted.

Indoor hotspot
R1-164383 Further discussion on evaluation assumption for eMBB deployment scenarios Huawei, HiSilicon
Decision: The document (Section 2.1) is noted.

R1-165483 Discussion on System-Level Evaluations for NR Samsung (R1-164718)
Decision: The document (Section 2) is noted.
Proposal for indoor open office: optional additional ISD of 40m –~~R1-165489~~
Friday
R1-165850 WF on antenna placement in Indoor scenarios Intel, NTT DoCoMo, Samsung, Ericsson
Decision: The document is agreed.

R1-165950 WF on Remaining Evaluation Assumptions NTT DOCOMO, Intel
Decision: The document is noted. Further revised and agreed in:
R1-166007 WF on Remaining Evaluation Assumptions NTT DOCOMO, Intel

R1-165994 WF on the antenna model for outdoor TRP Intel, NTT DOCMO
Decision: The document is noted. Further revised and agreed in:
R1-166026 WF on the antenna model for outdoor TRP Intel, NTT DOCOMO, ZTE, Samsung, Xinwei, CATT, Ericsson, Nokia, ASB, Huawei
Email approval about brackets in R1-166026 until June 9th - (Intel)

R1-165982 WF on UE antenna number Huawei, HiSilicon
Decision: The document is noted.
R1-166011 WF on UE antenna number Huawei, HiSilicon

- For UE at 70GHz, companies are also allowed to investigate the case with 64 total number of antenna elements
  - The number of TXRUs remains the same as 30GHz

R1-164677 mmW related simulation assumption parameters Qualcomm Incorporated

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Decision: The document is noted.

Agreements:

Attributes	Values or assumptions
Maximum Tx power	BS: Above 6GHz: 23 dBm for system bandwidth ≥ 100MHz. EIRP should not exceed [51] dBm (NOTE1). UE: 30GHz: 23dBm 70GHz: 21dBm EIRP should not exceed 43 dBm (NOTE1).
UE receiver noise figure	Below 6GHz: 9dB Above 6GHz: 13dB (baseline performance), 10dB (high performance)
Traffic model	Alt. 1: Full buffer Alt. 2: FTP Proposal: Consider full buffer and FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded). Other traffic models are not precluded.
Traffic load (Resource utilization)	For baseline scheme: 25%, 50%, 80% (other value is not precluded)
NOTE1: See Appendix in R1-164383 for the derivation of maximum allowed EIRP	

R1-165693 **Way Forward on UE Noise Figure** **Straight Path, Samsung, Intel, Nokia, KT**
Decision: The document is noted.
R1-165742 **WF on UE Receiver Noise Figures** **Samsung, Ericsson, Intel, Nokia, ZTE, MediaTek, Straight Path, KT Corp., Verizon, ETRI, IITH, CeWiT, Reliance-jio, Tejas Networks, Fiberhome, Sony, Coolpad, InterDigital, Potevio, Mitsubishi Electric, SK Telecom, OPPO, Lenovo, Skyworks, Xiaomi, AT&T**
Decision: The document is noted.

Dense urban
R1-164383 **Further discussion on evaluation assumption for eMBB deployment scenarios** **Huawei, HiSilicon**
Decision: The document (Section 2.2) is noted.

Agreements:

Attributes	Values or assumptions
Carrier frequency	Micro layer: Around 30GHz, 4 GHz; optional: 70GHz
Aggregated system bandwidth	Around 30GHz and 70GHz: Up to1GHz (DL+UL)
Tx power	Micro BS: Proposal: 4 GHz: 33dBm for 20MHz system bandwidth – check on Wed Above 6GHz: 33 dBm for system bandwidth ≥100MHz. EIRP should not exceed [69] dBm (NOTE1). UE: 30GHz: 23dBm 70GHz: 21dBm EIRP should not exceed 43 dBm (NOTE1).
UE receiver noise figure	Below 6GHz: 9dB Above 6GHz: 13dB
Traffic model	Alt. 1: Full buffer Alt. 2: FTP Proposal: Consider full buffer and FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded). Other traffic models are not precluded.
Traffic load (Resource utilization)	For baseline scheme: 25%, 50%, 80% (other value is not precluded)
NOTE1: See Appendix in R1-164383 for the derivation of maximum allowed EIRP	

R1-164243 Remaining issues on deployment scenarios CATT
Decision: The document is noted.

Agreement: Capture the following in 38.802:

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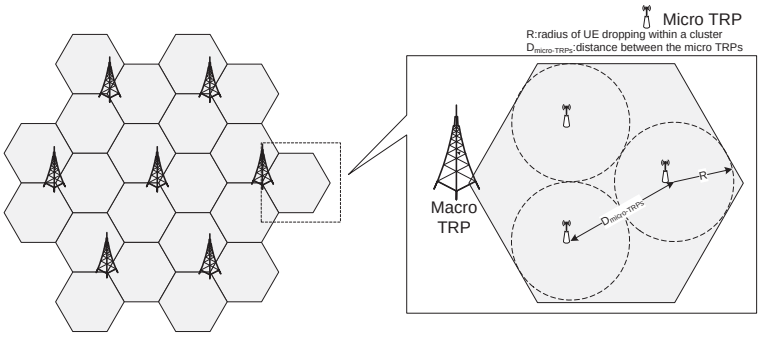


Figure: Layout illustration of deployment scenario of "Dense Urban": 3 Micro TRPs per Macro TRP

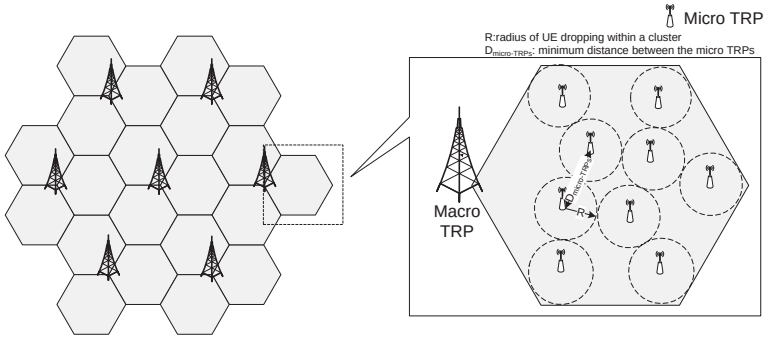


Figure: Layout illustration of deployment scenario of "Dense Urban": 9 Micro TRPs per Macro TRP

Table: Number of Micro TPP per Macro TRP vs. minimum distance between TRPs and UE cluster radius

Number of the micro TRPs per macro TRP	Minimum distance between Micro TRPs (m)	Radius of UE dropping within a cluster: R (m)
3	57.9	<28.9
6	42.4	<21.2
9	32	<16

Rural

R1-164383 **Further discussion on evaluation assumption for eMBB deployment scenarios** **Huawei, HiSilicon**

Decision: The document (Section 2.3) is noted.

Agreement:

Traffic model	Alt. 1: Full buffer Alt. 2: FTP Proposal: Consider full buffer and FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded). Other traffic models are not precluded.
Traffic load (Resource utilization)	For baseline scheme: 25%, 50%, 80% (other value is not precluded)

Urban macro

R1-164383 **Further discussion on evaluation assumption for eMBB deployment scenarios** **Huawei, HiSilicon**

Decision: The document (Section 2.4) is noted.

Agreements:

Attributes	Values or assumptions

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Tx power	BS: ~~Above 6~~30GHz: 43 dBm for system bandwidth ≥100MHz. EIRP should not exceed [78] dBm (NOTE1).. UE: 30GHz: 23dBm EIRP should not exceed 43 dBm (NOTE1).
UE receiver noise figure	Below 6GHz: 9dB Above 6GHz: 13dB
Traffic model	Alt. 1: Full buffer Alt. 2: FTP Proposal: Consider full buffer and FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded). Other traffic models are not precluded.
Traffic load (Resource utilization)	For baseline scheme: 25%, 50%, 80% (other value is not precluded)
NOTE1: See Appendix in R1-164383 for the derivation of maximum allowed EIRP	

High-speed

R1-164887 Remaining Evaluation Assumptions for High Speed Train Scenario CMCC

Decision: The document is noted.

R1-165576 WF on evaluaton assumptions for high speed train scenario CMCC, CATT, Huawei, CATR, China Unicom, ZTE

Decision: The document is noted. Also supported by Qualcomm.

Agreements:

- All proposals in R1-165576, with removal of "same cell ID" on slide 5.
- Other scenarios can be further discussed, e.g.:
  - 30GHz (see below)
  - Unidirectional beams

R1-164029 Clarification and proposals on parameters for high speed train scenarios Mitsubishi Electric Co.

Decision: The document is noted.

R1-165484 WF for high speed train scenario at 30GHz Mitsubishi, ETRI (Also supported by E///)

Decision: The document is agreed.

Notes:

- Focus is on evaluation of the base station to relay link.
- 1 relay node per train is assumed.

R1-164383 Further discussion on evaluation assumption for eMBB deployment scenarios Huawei, HiSilicon

Decision: The document (Section 2.5) is noted.

Agreements:

Attributes	Values or assumptions
UE receiver noise figure	Below 6GHz: 9dB Above 6GHz: 13dB
Traffic model	Alt. 1: Full buffer Alt. 2: FTP Proposal: Consider full buffer and FTP model 1/2/3 with packet size 0.5 Mbytes, 0.1 Mbytes (other value is not precluded). Other traffic models are not precluded.
Traffic load (Resource utilization)	For baseline scheme: 25%, 50%, 80% (other value is not precluded)

Extreme rural

R1-164680 Other KPI evaluation assumptions Qualcomm Incorporated

Decision: The document is noted.

Agreement:

- For the evaluation of Long Range (single cell SLS), consider a single cell radius target (e.g. 100km), and identify the data rate with which the edge users can be served; then observe how many users such a cell site can serve.

FFS: detailed parameters for long range scenarios – (Qualcomm) - R1-165485

R1-165485 WF on Extreme Long Range KPI Evaluation Qualcomm

Decision: The document is agreed.

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Friday

R1-165917 Way forward on High Speed Link Level evaluation Cohere, AT&T, CMCC, Deutsche Telekom, InterDigital, Orange, Spreadtrum, Telefonica, Telstra
Decision: The document is noted. Revised in:
R1-166020 Way Forward on High Speed link level evaluation Cohere, AT&T, CMCC, Deutsche Telekom, InterDigital, National Taiwan University, Orange, Spreadtrum, Telefonica, Telstra
Decision: The document is noted. Further revised and agreed in R1-166031.

R1-165926 WF on additional evaluation assumptions for high speed train scenario: Macro + relay around 30GHz Mitsubishi Electric, ETRI, Ericsson
Decision: The document is noted.

Agreements:

- On additional evaluation assumptions for high speed train scenario: Macro + relay around 30GHz
  - Number of antenna elements of relay
    - Relay Tx: up to 256
    - Relay Rx: up to 256
    - Note: The antenna of the relay for RRH-to-Relay is located outside of a train
  - Number of antenna elements of RRH
    - RRH Tx: up to 256
    - RRH Rx: up to 256
    - Note: The above values are shown in TR 38.913

Continue discussion other proposals in R1-165926 offline

Friday

R1-166001 Proposal for email discussion on evaluation assumptions for high speed train scenario: Macro + relay around 30GHz Mitsubishi Electric, ETRI
Decision: The document is noted.
Conclusion: Agreed R1-166001 except for brackets and FFS parts
Email approval until June 8th about brackets and FFS parts – (Mitsubishi)

Urban coverage for massive connectivity
R1-164044 Evaluation assumption for non-eMBB deployment scenarios Huawei, HiSilicon
Decision: The document (Section 2.1) is noted.

Highway
R1-164044 Evaluation assumption for non-eMBB deployment scenarios Huawei, HiSilicon
Decision: The document (Section 2.2) is noted.

R1-164679 Highway and urban grid evaluation scenarios Qualcomm Incorporated
Decision: The document is noted.

R1-165612 WF on SLS evaluation assumptions for eV2X LG Electronics, Deutsche Telekom
Decision: The document is noted.

Offline discussion on evaluation assumptions for Highway / Urban Grid scenarios / eV2X – (LGE) - revisit on Wed.
R1-165704 WF on SLS evaluation assumptions for eV2X LG Electronics, Deutsche Telekom
Decision: The document is noted.

Agreements: (including below add-on from Friday online session)

Parameters	Urban grid for eV2X	Highway for eV2X
Layout	Option 1: Macro only (with the road configuration in Figure 6.1.10-1 in TR38.913) Option 2: Macro + RSUs (with the road configuration in Figure 6.1.10-1 in TR38.913) Note: An RSU can be a BS type RSU or UE type RSU Out of coverage can be evaluated assuming eNB or RSU to be disabled. Sidelink evaluation with partly out of coverage Ues and partly in coverage Ues are FFS.	Option 1: Macro only (straigntline eNB placement with Road configuration in TR36.885) Option 2: Macro + RSUs (straightline eNB with Road configuration in TR36.885) Note: An RSU can be a BS type RSU or UE type RSU Out of coverage can be evaluated assuming eNB or RSU to be disabled. Sidelink evaluation with partly out of coverage Ues and partly in coverage Ues are FFS.

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Inter-BS distance	Inter Macro: 500m Inter RSU: RSU is dropped at each intersection	Inter Macro: 1732m, 500m (optional) Inter RSU: Uniform allocation with 100m spacing in the middle of the highway
Carrier frequency	Macro to/from vehicle/pedestrian UE : 4 GHz Between vehicle/pedestrian UE: 6 GHz BS-type-RSU to/from vehicle/pedestrian UE : 4 GHz UE-type-RSU to/from vehicle/pedestrian UE: 6 GHz Note: Agreed value does not mean non-ITS band is precluded for real deployment for sidelink	Macro to/from vehicle/pedestrian UE : 2 GHz or 4GHz Between vehicle/pedestrian UE: 6 GHz BS-type-RSU to/from vehicle/pedestrian UE : 4 GHz UE-type-RSU to/from vehicle/pedestrian UE: 6 GHz Note: Agreed value does not mean non-ITS band is precluded for real deployment for sidelink
Aggregated system bandwidth	Up to 200 MHz (DL+UL) Up to 100 MHz (SL)	Up to 200 MHz (DL+UL) Up to 100 MHz (SL)
Simulation bandwidth	20 or 40 MHz (DL+UL) 10 or 20 MHz (SL)	20 or 40 MHz (DL+UL) 10 or 20 MHz (SL)
Channel model	Macro to/from vehicle/pedestrian UE : 3D UMa Between vehicle/pedestrian UE: V2X Channel model in TR36.885 RSU to/from vehicle/pedestrian UE : V2X Channel model in TR36.885 FFS whether V2V channel model enhancements are needed	Macro to/from vehicle/pedestrian UE: 3D UMa for 500m ISD 3D RMa for 1732m ISD (2D RMa may be used until 3D RMa is complete) Between vehicle/pedestrian UE: V2X Channel model in TR36.885 RSU to/from vehicle/pedestrian UE : V2X Channel model in TR36.885 FFS whether V2V channel model enhancements are needed
Tx power	Macro BS: 49dBm PA scaled with simulation BW when system BW is higher than simulation BW. Otherwise, 49dBm [TBD for TDD] BS-type-RSU: 24dBm PA scaled with simulation BW when system BW is higher than simulation BW. Otherwise, 24dBm Vehicle/pedestrian UE or UE type RSU: 23dBm Note: 33dBM for RSU or UE is not precluded	Macro BS: 49dBm PA scaled with simulation BW when system BW is higher than simulation BW. Otherwise, 49dBm [TBD for TDD] BS-type-RSU: 24dBm PA scaled with simulation BW when system BW is higher than simulation BW. Otherwise, 24dBm Vehicle/pedestrian UE or UE type RSU: 23dBm Note: 33dBM for RSU or UE is not precluded
BS antenna configuration	Macro BS: Up to 256 TX/RX antenna elements BS-type-RSU: Up to 8 TX/RX antenna elements	Macro BS: Up to 256 TX/RX antenna elements BS-type-RSU: Up to 8 TX/RX antenna elements
BS antenna pattern	Macro BS: Follow the modeling of TR 36.873 BS-type RSU: Follow the modeling of TR 36.873 Note: Further study if needed, e.g., vertical beamforming, vehicle-to-vehicle channel.	Macro BS: Follow the modeling of TR 36.873 BS-type RSU: Follow the modeling of TR 36.873 Note: Further study if needed, e.g., vertical beamforming effect, vehicle-to-vehicle channel.
BS antenna height	Macro BS: 25m BS-type-RSU: 5m	Macro BS: 35m for ISD 1732m 25m for ISD 500m BS-type-RSU: 5m
BS antenna element gain + connector loss	Macro BS: 8 dBi BS-type-RSU: 8dBi	Macro BS: 8 dBi BS-type-RSU: 8dBi
BS receiver noise figure	Macro BS:5dB BS-type-RSU: 5dB	Macro:5dB BS-type-RSU: 5dB
UE antenna elements	Vehicle/pedestrian UE: Up to 8 TX/RX antenna elements UE-type RSU: Up to 8 TX/RX antenna elements	Vehicle/pedestrian UE: Up to 8 TX/RX antenna elements. UE-type RSU: Up to 8 TX/RX antenna elements
UE antenna pattern	Vehicle/pedestrian UE: Half spherically uniform distribution with upper direction UE-type-RSU: Half spherically uniform distribution with bottom direction Note: directional antenna pattern is not precluded Note: uniform antenna models should be used for 2-D channel models	Vehicle/pedestrian UE: Half spherically uniform distribution with upper direction UE-type-RSU: Half spherically uniform distribution with bottom direction Note: directional antenna pattern is not precluded Note: uniform antenna models should be used for 2-D channel models
UE antenna height	Vehicle/pedestrian UE: 1.5m UE-type-RSU: 5 m	Vehicle/pedestrian UE: 1.5m UE-type-RSU: 5 m

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UE antenna gain	Vehicle UE: 3dBi Pedestrian UE: 0dBi UE-type RSU: 3dBi	Vehicle UE: 3dBi Pedestrian UE: 0dBi UE-type RSU: 3dBi
UE receiver noise figure	Vehicle UE: 9dB UE-type RSU: 9dB	Vehicle UE: 9dB UE-type RSU: 9dB
Traffic model	[50 messages] per 1 second with [60km/h], [10 messages] per 1 second with [15km/h] in TR38.913 Note: This value is tentative. After SA1 input, it can be modified.	[50 messages] per 1 second with absolute average speed of [100-250 km/h] (relative speed: 200 – 500km/h) in TR38.913 Note: This value is tentative. After SA1 input, it can be modified.
Traffic load (Resource utilization)	FFS	FFS
UE distribution	Urban grid model (car lanes and pedestrian/bicycle sidewalks are placed around a road block. 2 lanes in each direction, 4 lanes in total, 1 sidewalk, one block size: 433m x 250m) in TR38.913 Average inter-vehicle distance (between two vehicles' center) in the same lane is [1sec * average vehicle speed] (average speed [15 – 120km/h]) in TR38.913 Vehicle UE location update in TR36.885 should be used for the evaluation of PRR in sidelink or communication interruption in uplink/downlink. Vehicle UE location update may not be assumed for the evaluation of PRR in uplink/downlink Note: Inter-vehicle distance is tentative. After SA1 input, it can be modified. Pedestrian UE distribution: Inter-pedestrian distance 20m, which is tentative. After SA1 input, it can be modified.	Average inter-vehicle distance (between two vehicles' center) in the same lane is [0.5 sec or 1sec * average vehicle speed] (average speed: [100-250 km/h]) in TR38.913 Vehicle UE location update in TR36.885 should be used for the evaluation of PRR in sidelink or communication interruption in uplink/downlink. Vehicle UE location update may not be assumed for the evaluation of PRR in uplink/downlink Note: Inter-vehicle distance is tentative. * After SA1 input, only one value will be selected.
Feedback assumption	FFS	FFS
Channel estimation	Realistic	Realistic
Performance metric	FFS	FFS

Friday: Email discussion on performance metrics, starting from the ones in R1-165612, till August 6th .

Urban Grid
R1-164044 **Evaluation assumption for non-eMBB deployment scenarios** **Huawei, HiSilicon**
Decision: The document (Section 2.3) is noted.

Other mMTC assumptions
R1-165008 **UE battery life evaluation for mMTC use cases** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.

Conclusion:

- Discuss until RAN1#86 to define simple UE energy modelling approach for NR mMTC radio access energy efficiency analysis which is not specific to any particular radio access solution (contact: Karri Ranta-aho)

R1-165696 **WF on evaluation methodologies for mMTC** **LG Electronics, Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.

Agreements:

- Evaluation methods and relevant evaluation metrics per KPIs for mMTC in RAN1 are as follows:
  - Coverage is evaluated by link budget
  - Connection density is evaluated by SLS and analysis
  - UE battery life is evaluated by analysis
    - Statistics of wake-up time duration of UE in consideration of the number of (re)transmissions
  - Battery life is evaluated in consideration of RAN2 procedure

Other URLLC assumptions
R1-164681 URLLC KPI evaluation assumptions Qualcomm Incorporated
Decision: The document is noted. Discuss these proposals offline, including:

- the exact definition to be used for latency evaluation
- reliability KPI:

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Revisit on Tuesday evening - R1-165487
R1-165487 **WF on URLLC KPIs and Evaluation** **Qualcomm**
Decision: The document is noted.

Proposed Working Assumption for URLLC KPIs:
- URLLC latency and reliability KPIs are defined in conjunction
  - (Latency, Reliability) of (L, R) is met if packet of X bytes is delivered within L ms latency from radio protocol ingress point to egress point with packet error rate < R.
  - E.g., (1ms, 1e-5)

Revisit later in the week.
Friday: To be revisited at next meeting.

Agreements:
The following performance metrics are defined for evaluation and feature selection in RAN1 (FFS the method of evaluation, including whether SLS are required):
- URLLC capacity is defined as delivered traffic given the (L, R) constraint
  - Denoted as C(L,R)
- URLLC/ eMBB multiplexing capacity is defined as the simultaneously delivered URLLC capacity *C(L,R)* and eMBB capacity *T*

FFS until RAN1#86:
- Proposal 1: Single URLLC traffic model should be used evaluate URLLC KPIs
  - Example: Fixed packet size of 32 Bytes, Poisson arrival rate of λ,
  - Example: single directional and bi-directional traffic could be considered
- Proposal 2: Latency metric should capture transmission latency, processing latency, retransmission latency and queuing/scheduling latency
- Proposal 3: Link level BLER evaluation should include control and data channels
  - With and without other cell interference
- Proposal 4: System level evaluation should capture other cell interferences

R1-163988 **Evaluation methodology and KPI for URLLC** **Samsung**
Decision: The document is noted.

V2X
R1-164173 **Discussion on URLLC evaluation assumptions and scenarios** **Intel Corporation**
Decision: The document is noted.

Conclusion: Aim for a single set of assumptions for evaluations of URLLC.

MIMO & antenna modelling
R1-164950 **On new antenna model for NR basestation** **Ericsson**
Decision: The document is noted.

Agreements:
- TXRUs within a panel can be assumed to be synchronized and phase-calibrated (at least to the same level as in LTE).
- It should be possible as one option to assume QCL between ports of two different panels of the same transmission points
- Distances ($d_{g,H}$, $d_{g,V}$) between panels should be limited to at most [FFS] metres.
- NR evaluations may consider both cases of phase-calibration and no phase-calibration between panels

R1-163986 **Remaining details of TRP antenna modeling and TXRU mapping/virtualization** **Samsung**
Discussion: Telecom Italia insists on realistic numbers of antenna elements at lower frequencies.
Decision: The document is noted.

R1-165488 **WF on TRP antenna model** **Samsung, Intel, Ericsson**
Decision: The document is noted. Revisit on Wednesday.

R1-164554 **Proposal for UE antenna model for new RAT** **LG Electronics**
Decision: The document is noted.
R1-165712 **WF on hybrid UE antenna modelling** **Intel, Samsung, LG**

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Decision: The document is noted.

Companies are requested to check both R1-165488 (->R1-165490) and R1-165712 (->R1-165491) by the end of the morning coffee break; WF owners to provide editable versions (in Word).

R1-165490 Way-forward for TRP antenna modeling Samsung, Intel, Ericson, Qualcomm, Xinwei

Decision: The document is noted.

Agreements on TRP antenna modelling:

- For evaluation, consider the following antenna configurations:
  - Baselines are at least for MIMO-related calibration (and can also be used for other features unless a different baseline is defined for evaluation of a particular feature). Companies are encouraged to evaluate other configurations as well.
  - **At 4GHz:**
    - Dense urban and Urban macro:
      - Baseline: (M,N,P,Mg,Ng) = (8,8,2,1,1), (d_V,d_H) = (0.8, 0.5)λ.
      - Note that for Urban macro, companies are also encouraged optionally to investigate larger panels, e.g. (8,16,2,1,1)
    - Indoor hotspot:
      - FFS
  - **At 30GHz:**
    - Dense urban and Urban macro:
      - Baseline: (M,N,P,Mg,Ng) = (4,8,2,2,2). (d_V,d_H) = (0.5, 0.5)λ. ($d_{g,V}$,$d_{g,H}$) = (2.0, 4.0)λ.
      - Note that companies are also encouraged to investigate a larger panel spacing, e.g. ($d_{g,V}$,$d_{g,H}$) = (4,8) λ
    - Indoor hotspot:
      - FFS
  - **At 70GHz:**
    - Dense urban:
      - Baseline: (M,N,P,Mg,Ng) = (8,16,2,2,2). (d_V,d_H) = (0.5, 0.5)λ. ($d_{g,V}$,$d_{g,H}$) = (4.0, 8.0) λ.
      - Note that companies are also encouraged to investigate a larger panel spacing, e.g. ($d_{g,V}$,$d_{g,H}$) = (8,16) λ
    - Indoor hotspot:
      - FFS

- Consider the following a TXRU to antenna elements mapping as examples
  - **At 4GHz:** the same as TR36.897
  - **At 30GHz and 70GHz:**
    - **Option 1:** a single TXRU is mapped per panel per polarization.
    - **Option 2**: a single TXRU is mapped per panel per subarray per polarization,
      - E.g., where a subarray consists of consecutive M/2 vertical antennas and N/2 horizontal antennas with the same polarization.
      - Other subarray configurations are not precluded.
    - **Option 3**: Fully connected TXRU mapping within a panel per polarization.
      - Other Fully connected TXRU mapping is not precluded.
- For evaluating multi beam based approaches at 30GHz and 70GHz, consider the following:
  - TXRU to antenna mapping weights are adjustable and used to steer the panel beam direction in multi beam based approaches in time domain.
  - Companies should describe TXRU mapping weights for the panel beams

R1-165640 WF on antenna placement in Indoor scenarios Intel, NTT DOCOMO (R1-165587)

Decision: The document is noted. Companies are invited to review this – revisit on Friday.

Agreements on UE antenna modelling:

- For UE with (M_g, N_g) directional antenna panels.
  - Introduce ($\Omega_{mg,ng}$, $\Theta_{mg,ng}$) for orientation of the panel (m_g, n_g), $0 \le m_g < M_g$, $0 \le n_g < N_g$, where the orientation of the first panel ($\Omega_{0,0}$, $\Theta_{0,0}$) is the same as UE orientation, $\Omega_{mg,ng}$ is the array bearing angle and $\Theta_{mg,ng}$ is the array downtilt angle defined in [TR 36.873].
  - For NR MIMO evaluation:
    - Config 1: (M_g, N_g) = (1, 2); $\Theta_{mg,ng}$=90; $\Omega_{0,1}=\Omega_{0,0}+180$; ($d_{gH}$, d_{gV})=(0,0)
    - Config 2: (M_g, N_g) = (1, 4); $\Theta_{mg,ng}$=90; $\Omega_{0,1}=\Omega_{0,0}+90$; $\Omega_{0,2}=\Omega_{0,0}+180$; $\Omega_{0,3}=\Omega_{0,0}+270$; ($d_{gH}$, d_{gV})=(0,0)
    - Other configurations can have panel specific position offset ($d_{gH,\,mg,\,ng}$, $d_{gV,\,mg,\,ng}$). Note in this case the notation of (M_g, N_g) does not leads to rectangular shape.

Field Code Changed

Field Code Changed

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- UE orientation for mobile device ($\Omega_{0,0}$, $\Theta_{0,0}$)=(U(0,360), 90); UE orientation for customer premise equipment (CPE) can be optimized
- Each antenna array has shape $d_H=d_V=0.5\lambda$
  - Config 1 can be used with config a/b; Config 2 can be used with config c/d/e
  - Config a: (M, N, P) = (2, 4, 2), the polarization angles are 0 and 90
  - Config b: (M, N, P) = (4, 4, 1) , the polarization angle for even panel is 0 and for odd panel is 90
  - Config c: (M, N, P) = (2, 2, 2), the polarization angles are 0 and 90
  - Config d: (M, N, P) = (2, 4, 1) , the polarization angle for even panel is 0 and for odd panel is 90
  - Config e: (M, N, P) = (1, 4, 2), the polarization angles are 0 and 90
  - FFS: Other configurations, e.g. (M, N, P) = (4, 4, 2) or (M, N, P) = (4, 8, 1) can be considered for 70GHz band, without exceeding the limit on the maximum number of UE antenna elements
- The antenna elements of the same polarization of the same panel is virtualized into one TXRU
- FFS: one TXRU can connect to different subarrays dynamically
- Note: The channel coefficients for each UE panel can be generated using spatial channel model

- Companies should describe the method used for TRP association with UE-side beamforming

UE PA model

R1-165006 **On the evaluation of PA model** **Nokia, Alcatel-Lucent Shanghai Bell**
Decision: The document is noted.
R1-164721 **On justification of the parameter selection for PA models in link level evaluation** **Huawei, HiSilicon**
Decision: The document is noted.
Conclusion: Discuss further when LS reply is received from RAN4.

Waveform

R1-164586 **LLS assumptions for waveform evaluation in mMTC UL transmissions** **Spreadtrum Communications**
Decision: The document is noted.
R1-165675 **Way forward on Case 5 for waveform LLS evaluation Spreadtrum, Orange, ZTE**
Decision: The document is noted.

R1-164034 **Further evaluation assumptions for waveform** **Huawei, HiSilicon**
Decision: The document is noted. To be revised in R1-165759 – revisit later
R1-165859 **Way forward on further evaluation assumptions for NR waveform** **Huawei, HiSilicon, InterDigital, NTT DOCOMO, LGE**
Decision: The document is agreed.

R1-165914 **WF on further evaluation assumptions for NR waveform 30GHz and beyond** **Nokia, Intel**
Decision: The document is noted. Continue discussion offline
Friday
R1-165989 **Way forward on calibration assumptions for NR waveform** **Huawei, HiSilicon, NTT DOCOMO, Nokia**

- Use an email discussion to collect the calibration results for all agreed simulation cases before RAN1#86 meeting.
  - OFDM/DFT-S-OFDM with CP as baseline for performance reference. (LMMSE receiver assumed)
  - At least BLER vs SNR should be reported for calibration

  Note: This calibration is not for down-select purpose.
  Note: The selection of the parameters on page 3 is only for calibration purpose

Decision: The document is agreed. Email discussion on calibration for NR waveform until June 30th - (Huawei)
R1-166016 **Way forward on email discussion for waveforms** **Huawei, HiSilicon, National Taiwan University, NTT DOCOMO, Nokia**

- Use an email discussion to collect information from each company on the details of their proposed/simulated waveform(s), including
  - used parameters
  - Tx/Rx structure
  - Corresponding performance
- Companies are encouraged to provide inputs to this email discussion as early as possible
- The purpose of this email discussion is to facilitate waveform discussion in future meetings. No conclusion is expected out of this email discussion

Decision: The document is agreed. Email discussion to collect information for NR waveform until August 4th - (Huawei)

R1-166000 **WF on further evaluation assumptions for NR waveform 30GHz and beyond** **Nokia, Alcatel-Lucent Shanghai Bell, Intel, Samsung, Huawei, HiSilicon**
Decision: The document is noted. Revised in:
R1-166028 **WF on further evaluation assumptions for NR waveform 30GHz and beyond** **Nokia, Alcatel-Lucent Shanghai Bell, Intel, Samsung, Huawei, HiSilicon,Qualcomm**

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Decision: The document is agreed.

Multiple Access
R1-163983 **Evaluation assumptions for NR multiple access** **Samsung**
Decision: The document is noted.
R1-164045 **SLS parameters for evaluation scenarios for multiple access evaluation** **Huawei, HiSilicon**
Decision: The document is noted.
R1-165691 **Way forward on remaining issues on multiple access evaluation assumption** **Huawei, HiSilicon**
Decision: The document is noted.

Agreements for SLS parameters for UL mMTC scenario – urban coverage for massive connection:

Attributes	Values or assumptions
Layout	Single layer - Macro layer: Hex. Grid
Inter-BS distance	1732m
Carrier frequency	700MHz
Simulation bandwidth	Companies report simulation bandwidth used in evaluation
Channel model	3D UMa Take 5GCM output into account if applicable.
Tx power	UE: Max 23dBm or optional 10dBm
BS antenna configuration	Rx: 2 and 4 ports (8 as optional)
BS antenna pattern	Follow the modeling of TR36.873
BS antenna height	25m
BS antenna tilt	Companies report tilt
BS antenna element gain + connector loss	8 dBi, including 3dB cable loss
BS receiver noise figure	5 dB
UE antenna elements	1Tx
UE antenna height	1.5m
UE antenna gain	-4dBi
Traffic model	Non-full buffer small packet. Consider future trend of mMTC traffic
UE distribution	20% of users are outdoor in cars (100km/h) or 20% of users are outdoors (3km/h) 80% of users are indoor (3km/h) Users dropped uniformly in entire cell
BS receiver	MMSE-IRC as baseline, Advanced receiver is not precluded
UL power control	Companies report power control scheme
Channel estimation	Realistic

- Notes:
  - The same table is also agreed to be used for general assumption for mMTC for UL
  - Additionally, it was agreed to additionally define the minimum packet size is [20] bytes

Discuss offline remaining slides in R1-165691, including LLS assumptions.
R1-165759 **Way forward on further evaluation assumptions for NR waveform** **Huawei, HiSilicon, InterDigital**
Decision: The document is noted.
R1-165848 **Way forward on mMTC evaluation assumptions**
Decision: The document is noted.
R1-165875 **Way forward on remaining issues on multiple access evaluation assumptions** **Huawei, HiSilicon**
Decision: The document is noted.

Agreement:
- PHY abstraction (L2S mapping) of LLS is encouraged to be provided for calibration purpose
- LLS evaluation with ideal and realistic channel estimation

Proposal:
- Slide 4 in R1-165875 is agreed, with the following updates:
  - BS: 49dBm / 10MHz for FDD and 20MHz for TDD
  - (eNB) 2/4/8 Tx/Rx ports as start point -> more than 2 ports
  - (UE) 1 Tx/2Tx and 2 Rx/4Rx as starting point
  - ~~25%,~~ 50%, 80% (other value is not precluded
  - For TRP spectrum efficiency: full buffer or ftp?
  - Uniform distribution, 10, ~~20 users~~ per TRP or more ~~for full buffer traffic~~

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- UE receiver and/or TRP receiver: Updated to Advanced receiver is not precluded?
- Scheduler?

Continue offline discussion

Friday

R1-166006 WF on remaining issues on SLS parameters for multiple access Huawei, HiSilicon, CATT, Orange, NTT DOCOMO, Vodafone

Decision: The document is noted.

Agreements:

- For multiple access evaluations for eMBB scenarios, both subband and wideband scheduler can be considered
- For multiple access evaluations for eMBB rural scenario:
  - Carrier frequency: 700MHz;
  - ISD: 1732m;
  - BS antenna configuration: 2/4/8 ports
  - UE antenna configuration: 2Tx/1Tx port, 2Rx/4Rx ports;
  - Traffic model:
    - For spectral efficiency: full buffer (NOTE)
    - For user experienced data rate: FTP model 1/3
  - UE density:
    - Full buffer: 10 UE per TRP, other values are not precluded;
  - Traffic load (FTP)
    - 50%, 80%, 25% (optional)
  - NOTE: full buffer evaluation is not used for technical scheme down selection.
- For multiple access evaluations for eMBB dense urban scenario:
  - Layout: Signal layer; Two layers not precluded
  - Carrier frequency: 4 GHz for the single layer
  - BS antenna TXRUs: 4, 8, 16, 32 TXRUs
  - UE antenna TXUs and RXUs: 2/1 TXUs, 2/4 RXUs
  - Traffic model:
    - For spectral efficiency: full buffer (NOTE)
    - For user experienced data rate: FTP model 1/3
  - UE density:
    - Full buffer: 10 UE per TRP, 20 or other values are not precluded;
  - Traffic load (FTP)
    - 50%, 80%, 25% (optional)
  - NOTE: full buffer evaluation is not used for technical scheme down selection
  - Note: Other parameters refer to general assumptions

R1-165916 WF on DL Multiple Access for eMBB MediaTek, Spreadtrum

Decision: The document is noted.

Initial evaluations

R1-166004 Response LS on realistic power amplifier model for NR waveform evaluation RAN4, Nokia

Decision: The document is noted.

R1-166010 WF on power amplifier assumptions for NR wavwform evaluations Nokia, Alcatel Lucent Shanghai Bell

Decision: The document is noted.

Working assumption:

- RAN1 adopts the models provided in RAN4 LS (R1-166004) to the NR UL waveform evaluations

Email discussion and approval about power amplifier assumptions for NR DL waveform evaluations by utilizing R1-166004 and R1-166010 and also email approval to confirm above WA until 9th June – Mihai (Nokia)

R1-165675 Way forward on Case 5 for waveform LLS evaluation Spreadtrum, Orange, ZTE

Decision: The document is noted.

Not treated.

R1-163985 Discussion on achieving data rate and spectral efficiency KPIs for NR Samsung
R1-163987 Remaining details of UE antenna modeling and TXRU mapping/virtualization Samsung
R1-164041 Phase noise model for above 6GHz Huawei, HiSilicon
R1-164174 Discussion on channel modeling framework for UE-UE and eNB-eNB interference Intel Corporation
R1-164175 Traffic model for small packet size Intel Corporation

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R1-164244 Remaining issues on link/system-level evaluation assumptions for MA CATT
R1-164245 Discussion on link-level evaluation assumptions for channel coding CATT
R1-164262 Remaining issue with link level simulation for multiple access ZTE
R1-164263 Remaining issue with system level simulation for multiple access ZTE
R1-164264 Requirement KPIs and system performance targets for multiple access ZTE
R1-164373 Evaluation methodology for Massive MIMO in New Radio Huawei, HiSilicon
R1-164391 Overview of remaining issues of evaluation assumption Huawei, HiSilicon
R1-164553 Evaluation assumptions for eV2X LG Electronics
R1-164555 Remaining Issues on Evaluation Assumptions for New Radio Interface LG Electronics
R1-164587 Further consideration on the evaluation assumption of multiple access Spreadtrum Communications
R1-164675 Initial DL KPI evaluation for eMBB Qualcomm Incorporated
R1-164676 Initial UL KPI evaluation for eMBB Qualcomm Incorporated
R1-164678 High speed train scenario clarification Qualcomm Incorporated
R1-164683 Multiple access evaluation assumption Qualcomm Incorporated
R1-164868 Evaluation assumptions for high speed scenario ETRI
R1-164888 Phase Noise in High Frequency Bands for New Radio SystemsCMCC
R1-164951 Scenarios and Evaluation methodology for NR Ericsson
R1-165005 On the evaluation of PN model Nokia, Alcatel-Lucent Shanghai Bell
R1-165009 System level simulation assumptions for mMTC use cases Nokia, Alcatel-Lucent Shanghai Bell
R1-165010 Waveform comparison simulation assumptions for 30 GHz and beyond Nokia, Alcatel-Lucent Shanghai Bell
R1-165078 Remaining details of NR evaluation assumptions Intel Corporation
R1-165424 On baseline UE receiver for NR ORANGE, Vodafone
R1-165443 Evaluation Assumptions for NR MIMO ZTE
R1-165491 WF on hybrid UE antenna modelling Intel, Samsung, LGE
R1-165633 Way Forward on SLS evaluation assumptions LG Electronics
R1-165690 WF on eMTC evaluation assumptions Huawei, HiSilicon
R1-165697 Way Forward on KPIs discussion for RAN1 evaluation LG Electronics
R1-165735 WF on assumption details for case 5 in waveform LLS evaluation Spreadtrum, Fraunhofer IIS, National Taiwan University, Orange, ZTE
R1-165930 WF on evaluation assumptions for eMBB LGE
R1-166005 WF on Channel coding selection Qualcomm Incorporated, ZTE

7.1.3 Waveform and multiple access schemes for new radio interface

7.1.3.1 Waveform

R1-164265 Discussion on FB-OFDM of new waveform for new radio interface ZTE

The document was presented by Yifei Yuan from ZTE.

- *Observation 1: FB-OFDM shares the same baseband signal formulation with some other OFDM-based multi-carrier waveforms including CP-OFDM, CP-OFDM with WOLA, FBMC, FBMC-OQAM and GFDM.*
- *Observation 2: Due to use of polyphase filter, FB-OFDM has the simple implementation in both transmitter and receiver.*
- *Observation 3: FB-OFDM has good flexibility and adaptability in choosing pulse functions and symbol intervals.*
- *Observation 4: Polyphase filter can be used with various OFDM-based multi-carrier waveforms. It is beneficial to make the NR waveform compatible with polyphase filter for the NR forward compatibility.*
- *Observation 5: FB-OFDM has much better OOB performance than CP-OFDM, particularly in the region closing to the edge of transmission band.*
- *Observation 6: FB-OFDM performs better than CP-OFDM when adjacent subbands have different numerologies.*
- *Proposal: To include FB-OFDM with polyphase filter as a waveform scheme in the further NR study.*

Decision: The document is noted.

R1-164619 Flexibly configured OFDM (FC-OFDM) waveform ORANGE

The document was presented by Hao Lin from Orange.

- Proposal 1: Study FC-OFDM as a solution to enable multiple configuration modes' 'multiplexing in frequency domain, allowing necessary flexibility for the NR to support different use cases.
- Proposal 2: Study FC-OFDM as a solution for window design in time domain bringing advantages in terms of support of flexible numerology, coexistence of sync/non-sync transmission, spectral confinement.

Decision: The document is noted.

R1-165011 OFDM based Waveform for 5G new radio interface Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by Karri Ranta-aho from Nokia.

- *Proposal 1: Zero prefix with short sub-band wise filter should be considered when multiplexing different numerologies at low bands.*
- *Proposal 2: PA model needs to be considered into final evaluation of sub-band wise filtered waveforms.*

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- *Proposal 3: UL/DL symmetric CP-OFDMA should be used for eMBB optimized frequency band 3-40 Ghz.*
- *Proposal 4: Single carrier without carrier aggregation should be considered for frequency bands over 40 Ghz*
- *Proposal 5: Replacement of CP by zero value which are part of the symbol itself needs to be considered.*

Decision: The document is noted.

R1-164355 Circularly Pulse Shaped OFDM-based Waveform Idaho National Laboratory

The document was presented by Ramon Khalona from INL.

- *Proposal: DFT-S-OFDM should be considered as the baseline waveform for the uplink due its PAPR performance.*
- *Proposal: Filtering/windowing techniques must be added to the DFT-S-OFDM to improve its OOBE characteristics.*
- *Observation: To meet the NR requirements such as improving battery life of the mMTC and D2D devices new functionalities must be added to improve the existing OFDM-based DFT-S-OFDM waveform.*
- *Observation: Circular Pulse Shaping provides significant gain of at least 1.2dB and at least 3.2dB over DFT-S-OFDM and OFDM respectively.*
- *Proposal: RAN1 should consider SC-CPS-FDMA because of its improved PAPR performance over SC-FDMA while still providing all the benefits of SC-FDMA.*
- *Observation: SC-CPS-OFDM is amicable to MIMO technologies and provides greater flexibility for CFO compensation.*

Decision: The document is noted.

R1-165035 [NR] 5G waveforms PAPR and out of channel emissions measurements Skyworks Solutions Inc.

The document was presented by Dominique Brunel from Skyworks.

- Proposal 1: Refocus efforts on reduced PAPR for the 5G NR UL, whether
  - Retaining the present PAPR performance of single-carrier SC-FDMA as in LTE-A,
  - Revisiting encoding and multiple access schemes that enable PAPR reduction, and
  - Explore alternative means to guarantee out-of-channel emissions than simply to rely on native PA linearity at significant DC current consumption penalty for the UE.
- Proposal 2
  - LTE and Wi-Fi PA measurements results with candidate waveforms shall serve as the benchmark for modelling.
  - Impact of memory effect for higher frequencies and wider bandwidths as intended by NR/5G shall be assessed for power amplifier modelling.
- Observation 1
  - For a fully allocated channel, at the output of the PA, initial waveform localization properties are lost and out-of-channel spectral emissions are degraded to the same values limited by the PA nonlinearity.
  - For a fully allocated channel, higher PAPR waveforms result in lower transmitted power and reduced DC efficiency
- Observation 2
  - For a partially allocated channel, at the output of the PA initial waveform localization properties are lost and out-of-channel emissions are degraded to the same values limited by the PA nonlinearity
  - For a partially allocated channel, higher PAPR waveforms result in lower transmitted power and reduced DC efficiency
- Observation 3: Both LTE high band and Wi-Fi 5GHz high performance PAs are good candidates for modelling and testing NR waveforms at less than 6GHz frequencies for channel bandwidths at least equal to 200MHz.
- Observation 4: Simple AM/AM + AM/PM model is not representative of power amplifier non linear behaviour for wide bandwitdth and/or frequencies higher than 6GHz. Models accounting for memory effects, bias network bandwidth limitations, etc. should be studied in order to refine the accuracy and predictability of such models. Application of PA models for mm Wave will also need to be inclusive of additional parasitics and test method limitations.

Decision: The document is noted.

R1-165113 OFDM-Based Waveform With Precoding Techniques National Taiwan University

The document was presented by … from NTU.

- Proposal: For any OFDM-based waveform, both frequency-domain precoding and time-domain filtering techniques for low OOBE shall be considered.
- Observation: GFDM can be regarded as a precoded-OFDMA waveform that meets the objective of this study item [1]:
  - Fundamental physical layer signal structure for new RAT
    - Waveform based on OFDM, with potential support of non-orthogonal waveform and multiple access

Decision: The document is noted.

R1-165257 Link level evaluation of waveforms for open-loop synchronized Uplink KDDI Corporation

The document was presented by … from KDDI.

- *Observation 1: In an open-loop synchronized Uplink scenario, ZT-OFDM presents performance close to the case with zero delay for moderate SNR and reaches an error floor (below BLER = 1e-2 for 16-QAM) at high SNR.*

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- *Observation 2: In an open-loop synchronized Uplink scenario, the use of low power tail truncation, in addition to providing potential energy saving gains, appears beneficial to the performance when performed at a local minimum of the low power tail of the time-domain waveform.*
- *Proposal: We suggest that in future evaluations, the case in which the ratio of IDFT and DFT sizes at the transmitter is an integer may be considered, as it results in specific time-domain characteristics of the ZT-OFDM waveform with the potential to increase the performance gain obtained by truncation of the low power tail.*

Decision: The document is noted.

R1-164028 Link-level evaluation results for UW-DFT-s-OFDM Mitsubishi Electric Co.

The document was presented by Cristina Ciochina-Duchesne from Mitsubishi.

- Observation 1: UW DFT-s-OFDM has superior OoB suppression performance with respect to SC-FDMA.
- Observation 2: UW-DFT-s-OFDM and SC-FDMA have the same PAPR performance.
- Observation 3: DFT-FDE-IDFT modules in LTE-SC-FDMA can be used for UW-DFT-s-OFDM and CP removal module is not needed
- Observation 4: UW serves as CP and sufficient FER performance can be obtained by controlling length of UW
- Observation 5: At the OOBE target 26.3dB, UW DFT-s-OFDM outperforms SC-FDMA at SNR below 30dB in the ETU channel. In the EPA channel, UW DFT-s-OFDM outperforms SC-FDMA.
- Observation 6: UW-DFT-s-OFDM is robust against interference from adjacent channels
- Observation 7: UW-DFT-s-OFDM is a waveform with suppressed OOBE, robust performance in multipath fading and tolerance against adjacent channel interference.
- Proposal 1: Investigate UW-DFT-s-OFDM as a potential waveform candidate
- Proposal 2: Investigate location and length of UW for UW-DFT-s-OFDM to achieve the best tradeoff

Decision: The document is noted.

R1-165620 Performance Results for OTFS Modulation Cohere Technologies

The document was presented by … from Cohere and provides performance comparisons showing the superior performance of OTFS especially in the high mobility (high speed train) use case; 6 dB improvement or more is seen at vehicle speeds of 500 Km/h. This kind of improvement can allow high throughput operation in high mobility cases without requiring increasing the subcarrier spacing and incurring the increased CP overhead associated with a larger subcarrier spacing.

Decision: The document is noted.

R1-165108 Waveform candidates for NR Motorola Mobility

The document was presented by … from MotM.

- RAN1 should consider additional criteria/metrics for evaluation of waveforms for downlink and uplink, such as complexity/efficiency of pilot signal generation/channel estimation, integration/pairing with MIMO, latency/efficiency of short-packets transmission / reception, time/frequency synchronization robustness.
  - A metric may have a different degree of importance for sub-6Hz and >6GHz frequency bands.
- The criteria/metrics should be used to study benefits of new waveforms over LTE OFDM/SC-FDM waveform with improved (e.g., 95%) bandwidth occupancy.

Decision: The document is noted.

R1-165648 WF on OFDM based waveform in NR Samsung

- The following OFDM-based waveform variants should be evaluated for RAN1 NR waveform candidates
  - OFDM with guard interval (e.g., CP, ZP, …)
  - DFT-s-OFDM with guard interval
    - SC-FDE with guard interval can be considered as a special case of DFT-s-OFDM
  - Note: Each company should provide details on the DFT-spreading, filtering/windowing applied to OFDM waveform for evaluation
    - RAN1 strives for minimization of the number of waveform(s) supported in NR considering performance, specification impact, and UE/eNB complexity

Discussion: Huawei → no real progress compared to what has been already agreed.

Decision: The document is noted.

Possible agreements:

- The following OFDM-based waveform variants should be evaluated for RAN1 NR waveform candidates
  - OFDM with guard interval (e.g., CP, ZP, …)
  - DFT-s-OFDM with guard interval
    - SC-FDE with guard interval can be considered as a special case of DFT-s-OFDM
  - Filtering and/or windowing on OFDM/DFT-s-OFDM with guard interval
  - Note: Each company should provide details on the DFT-spreading, filtering/windowing applied to OFDM waveform for evaluation

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- RAN1 strives for minimization of the number of waveform(s) supported in NR considering performance, specification impact, and UE/eNB complexity

Wednesday:

Agreements:

- The following OFDM-based waveforms should be used as RAN1 NR waveform performance reference:
  - OFDM with CP
  - DFT-s-OFDM with CP
- All waveform in RAN1 #84bis/#85 meeting can be evaluated based on agreed assumptions
  - Note: Each company should provide details on the DFT-spreading, guard interval, Tx/Rx filtering and/or windowing applied to OFDM waveform for evaluation

R1-165665 WF on definition of OFDM based waveform Spreadtrum, Orange, Sony, Cohere, NTU

The document was presented by Jinhui Chen from Spreadtrum.

- Definition: An OFDM-based waveform is a waveform based on IDFT(IFFT) operation.
  - Includes at least CP-OFDM, OFDM-WOLA, f-OFDM, FB-OFDM, UFMC, GFDM, W-OFDM, FBMC-OQAM, FC-OFDM, UW DFT-S-OFDM, GI DFT-S-OFDM, DFT-S-OFDM, variants of DFT-S-OFDM, OTFS, etc.

Discussion: Spreadtrum very upset and stressed for targetting to select/narrow-down options without much evaluation results been presented yet.

Decision: The document is noted.

R1-165666 Way forward on categorization of IFFT-based waveform candidates Orange, Spreadtrum, InterDigital, ZTE, Cohere, Telstra

Categorization of IFFT-based waveform candidates can be summarized as:

	time domain windowing	**time domain filtering**	**w.o. windowing/filtering**
multi-carrier (MC)	FBMC-OQAM FB-OFDM FC-OFDM GFDM W-OFDM OTFS*	f-OFDM FCP-OFDM UF-OFDM OTFS*	CP-OFDM OTFS
single-carrier (SC)	DFT spreading + TDW MC candidates	DFT spreading + TDF MC candidates	

* Application of time domain windowing or filtering to OTFS is FFS

Decision: The document is noted.

Thursday

R1-165857 Summary and observations on simulation results in Cases 1a, 1b and 2 Spreadtrum, Orange, National Taiwan University, ZTE

- Observation: Under the given simulation assumptions, most new waveforms discussed so far outperform CP-OFDM/DFT-S-OFDM(SC-FDMA) for Case 1a, 1b, 2.

Decision: The document is noted.

Not treated.

R1-163989 Waveform for NR Samsung
R1-163990 Preliminary evaluation results for OFDMA-based waveforms Samsung
R1-163991 Orthogonal vs. non-orthogonal waveforms for NR Samsung
R1-164176 Discussion on waveform for high frequency bands Intel Corporation
R1-164177 Link-level evaluation of filtered/windowed OFDM Intel Corporation
R1-164266 Simulation results of new waveform in case 1a and 1b ZTE
R1-164267 Simulation results of new waveform in case 2 ZTE
R1-164327 On coexistence of new waveforms for NR Fujitsu
R1-164369 Discussion on waveform for high frequencies Huawei, HiSilicon
R1-164588 Initial LLS evaluation results of NR waveforms under case 1a/1b/2 Spreadtrum Communications
R1-164629 On OFDM in NR Ericsson
R1-164655 Discussion on filtered waveform for NR Sony
R1-164684 Single carrier waveform evaluation Qualcomm Incorporated
R1-164687 mmW waveform selection considerations Qualcomm Incorporated
R1-165012 New radio waveforms for the Multi-Service Air Interface below 6 GHz Nokia, Alcatel-Lucent Shanghai Bell

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R1-165013 Initial uplink performance results for new radio waveform for below 6GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-165014 Subband-wise filtered OFDM for New Radio below 6 GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-165015 Waveform proposal for carrier frequencies beyond 40 GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-165016 Potential for system level gains for low-PAPR waveforms Nokia, Alcatel-Lucent Shanghai Bell
R1-165057 Performance Evaluation of UW DFT-S-OFDM for UL INTERDIGITAL COMMUNICATIONS
R1-165065 Discussion on Unique Word DFT-S-OFDM Waveform for New Radio INTERDIGITAL COMMUNICATIONS, Mitsubishi Electric
R1-165114 Evaluation of OFDM-Based Waveforms National Taiwan University
R1-165161 Initial link level evaluation result for NR waveform MediaTek Inc.
R1-165173 Comparison of candidate waveforms NTT DOCOMO, INC.
R1-165401 Initial downlink performance results for new radio waveform for below 6GHz Nokia, Alcatel-Lucent Shanghai Bell
R1-165422 Performance of GPO and OFDM with PA model and windowing IITH, CEWiT, Reliance-jio, Tejas Networks
R1-165423 Performance evaluation of FC-OFDM ORANGE
R1-165425 f-OFDM scheme and filter design Huawei, HiSilicon
R1-165426 Link level evaluation results of waveform proposals Huawei, HiSilicon
R1-165434 Initial Evaluation Result for waveform LG Electronics
R1-165580 OFDM based waveform single user evaluation Qualcomm Incorporated
R1-165581 OFDM based waveform multi-user evaluation Qualcomm Incorporated
R1-165584 Design target and initial evaluation results on waveform for NR Panasonic Corporation

7.1.3.2 Multiple access scheme

R1-163992 Non-orthogonal multiple access candidate for NR Samsung

The document was presented by … from Samsung.

- *Observation 1: The aforementioned NoMA schemes have potential to accommodate more users with limited resource, which is subject to the availability of well-designed codebooks or code sequences. It may be challenging to provide well-designed code resources for multiplexing large number of UEs in one dimension with a view to future proof.*
- *Observation 2: To bring NoMA supporting large number of UEs into reality, multi-user detection (MUD) with practically feasible complexity MUST be viable, which needs further careful verification.*
- *Observation 3: IGMA provides flexibility to choose bit level interleavers and/or grid mapping pattern to separate users. With the abundant source generated by bit-level interleavers and grid mapping patterns, the scalability to support different connection densities could be easily supported.*
- *Observation 4: The symbol-level interleaving randomizes the symbol sequence order, which may further bring benefit in terms of combating frequency selective fading and inter-cell interference.*
- *Observation 5: The IGMA scheme could apply relatively low-complexity multi-user detector and sparse grid mapping pattern could further reduce detection complexity.*
- *Proposal 1: the interleaver-based multiple access scheme (IGMA) should be evaluated as a candidate multiple access scheme for NR.*
- *Proposal 2: The proposed NoMA schemes should be evaluated taking into account their performance improvements, impact on receiver complexity, and feasibility of required specification support.*

Decision: The document is noted.

R1-164329 Initial LLS results for UL non-orthogonal multiple access Fujitsu

The document was presented by … from Fujitsu.

- *Observation 1: LDS CDMA seems to be a simple and effective multiple access scheme.*
- *Observation 2: RE mapping across RBs has the potential to save reference signals and gain from diversity.*
- *Observation 3: User signature vector extension by transforming two signature vectors into a larger vector has a potential to further exploit diversity gain.*
- *Proposal 1: Consider RE mapping across RBs for LDS (low density spreading) types of multiple access.*
- *Proposal 2: User signature vector extension can be considered for performance enhancement.*
- *Proposal 3: Consider LDS CDMA as a candidate multiple access scheme.*

Decision: The document is noted.

R1-164656 Consideration on the Non-Orthogonal Multiple Access for NR Sony

The document was presented by … from Sony.

- Proposal 1: The power domain NOMA and the code domain NOMA, which includes the “Spreading”, “Scrambling” and/or “Interleaving” functions, should be considered.
- Proposal 2: RAN1 should consider new specific information which all superposed UEs can know without assistance information to ease the use of NOMA technologies.

Decision: The document is noted.

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R1-165019 Non-orthogonal multiple access for New Radio Nokia, Alcatel-Lucent Shanghai Bell

The document was presented by … from Nokia.

- Proposal 1: Both spreading and non-spreading based non-orthogonal multiple access shall be considered, targeting for diversified NR usage scenarios and use cases.
- Proposal 2: The design of the non-orthogonal multiple access needs to joint consider: the supported number of connections, the receiver complexity, the flexibility of resource allocation, the PAPR impact, the standard impact.
- Proposal 3: Non-orthogonal coded access (NOCA) using LTE defined low correlation sequences is taken as the baseline for spreading based non-orthogonal multiple access.

Decision: The document is noted.

R1-165021 Performance of Interleave Division Multiple Access (IDMA) in combination with OFDM family waveforms Nokia, Alcatel-Lucent Shanghai Bell

Proposal: Investigate IDMA and its combination with OFDM family waveforms w.r.t. frequency diversity gain, complexity and its potential in uplink in conjunction with service requirements (such as suitability for machine type communication with relaxed timing alignment).

Decision: The document is noted.

R1-165004 Contention based multiple access for NR uplink Sharp

The document was presented by … from Sharp.

- Multiple access scheme candidates should be categorized based on the principle of access scheme, e.g., code, or power.
- Multiple access scheme candidates should be studied considering their pros and cons, their ability to maximize KPIs for the NR RAT, and whether KPIs can be enhanced by combining aspects of these schemes.

Proposals:

- Each company is encouraged to report the receiver assumption and whether time-domain partial contention occurs or not in the evaluation.
- RAN1 should clarify not only system bandwidth but also transmission bandwidth of mMTC UEs for evaluations.

Decision: The document is noted.

R1-164869 Low code rate and signature based multiple access scheme for New Radio ETRI

The document was presented by … from ETRI.

- *Proposal 1: Non-orthogonal multiple access with asynchronous transmission should be investigated/evaluated for the uplink of mMTC.*
- *Proposal 2: At least for mMTC, LSSA can be considered as a candidate for non-orthogonal multiple access scheme, supporting massive connectivity and low power consumption.*

Decision: The document is noted.

R1-165653 WF on scenarios for non-orthogonal multiple access CATT

The document was presented by Yanping Xing from CATT.

- Besides the study of DL transmission from single TP, study multiple data streams from different TPs transmitting to a UE with non-orthogonal multiple access scheme for eMBB
- Evaluate the above scheme in the following scenarios
  - dense urban with two-layers
  - Indoor hotspot

Decision: The document is noted. Continue offline discussion.
Wednesday: CATT suggested continuing until next meeting.

R1-165618 WF on categorizing candidate multiple access schemes for NR CMCC, Huawei, HiSilion, CATT

The document was presented by … from CMCC.

- The Non-orthogonal MA can be categorized based on their way to superpose users:
- Category 1: Spreading based (e.g., MUSA, PDMA, SCMA etc)
  - Subcategories for the above categories are FFS.
- Category 2: Non-spreading based (e.g., NOMA etc)
- NR MA should support flexible selection and / or adjustment between orthogonal MA and non-orthogonal MA depending on specific conditions.

Discussion: Purpose for categorizing unclear (Ericsson)
ZTE→ purpose is to assess performances for each categories
Decision: The document is noted.

Possible observations:

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- More than 10 non-orthogonal MA schemes are proposed in the contribution of RAN-1 #85.
- Most proposed non-orthogonal MA schemes are Spreading based schemes.

Possible agreements:

- From preliminary LLS results presented in the extensive contributions of RAN-1 #85, non-orthogonal MA has been proved to have gain over orthogonal MA, especially in overloaded transmission scenarios.
  - The Non-orthogonal MA can be categorized based on their way to superpose users:
    - Category 1: Spreading based (e.g., MUSA, PDMA, SCMA etc)
      - Subcategories for the above categories are FFS.
    - Category 2: Non-spreading based (e.g., NOMA etc)
  - NR MA should support flexible selection and / or adjustment between orthogonal MA and non-orthogonal MA depending on specific conditions.

R1-165596 WF on categorization for multiple access schemes ZTE, ZTE Microelectronics, Qualcomm Inc.

The document was presented by Yifei Yuan from ZTE.

- For uplink mMTC scenario, the scheme categorization can be based on the way UEs' data are separated
  - Category 1: Spreading using random-like sequences or patterns
    - Examples as MUSA, RSMA, NCMA, NOCA, low code rate spreading
  - Category 2: Structured-codebook based
    - Examples as SCMA, PDMA
  - Category 3: Interleaving based
    - Examples as IGMA, IDMA

Decision: The document is noted.

R1-165702 WF on categorizing candidate multiple access schemes for NR CMCC, ZTE, Huawei, HiSilicon, CATT, Intel, INTERDIGITAL

- Non-orthogonal multiple access schemes can be categorized based on the ways to separate different users:
  - Category 1: Code domain based
  - Category 2: Interleaver based
  - Category 3: Power domain based
  - Schemes that have features of combined categories are not precluded.

Discussion: Intel withdrew their support.
Also supported by Qualcomm, Spreadtrum.
LGE: at least an answer regarding their concern should be provided – what are the motivations of these categorizations?
DOCOMO: concern how the simulation results can/will be exploited?
Decision: The document is noted. Continue offline discussion.

R1-165595 WF on scenarios for multiple access ZTE, ZTE Microelectronics, InterDigital, Qualcomm Inc., Spreadtrum

The document was presented by Yifei Yuan from ZTE.

- Autonomous/grant-free/contention based UL non-orthogonal multiple access has the following characteristics
  - A transmission from UE does not need the dynamic and explicit scheduling grant from eNB
  - Each time in transmission, a UE randomly chooses a code/sequence or a pattern of interleaver from a pool known to eNB and UE before hand
  - Multiple UEs can share the same time and frequency resources
- For autonomous/grant-free/contention based UL non-orthogonal multiple access, the following should be studied
  - Collision of code/sequence/interleaver pattern from different UEs but on the same resource
  - Potentially relaxed requirement for UL synchronization (DL synchronization assumed)
    - Case 1: Timing offsets between UEs are within a cyclic prefix
    - Case 2: Timing offsets between UEs can be greater than a cyclic prefix, FFS the exact model of timing offsets
  - Potentially relaxed requirement for power control, i.e., no closed-loop
    - Case 1: Perfect open-loop power control, i.e., equal average SNR between UEs
    - Case 2: Realistic open-loop power control with certain alpha and P0 values
    - Case 3: no power control

Discussion: Also supported by ETRI.
Decision: The document is noted, modified and agreed as follows:

Agreements:

- Autonomous/grant-free/contention based UL non-orthogonal multiple access has the following characteristics
  - A transmission from UE does not need the dynamic and explicit scheduling grant from eNB
  - Multiple UEs can share the same time and frequency resources
- For autonomous/grant-free/contention based UL non-orthogonal multiple access, the following should be studied

- Collision of time/frequency resources from different UEs, solutions potentially including
  - E.g., code, sequence, interleaver pattern
- UL synchronization (DL synchronization assumed)
  - Case 1: Timing offsets between UEs are within a cyclic prefix
  - Case 2: Timing offsets between UEs can be greater than a cyclic prefix, FFS the exact model of timing offsets
- Requirement for power control
  - Case 1: Perfect open-loop power control, i.e., equal average SNR between UEs for potentially link level calibration
  - Case 2: Realistic open-loop power control with certain alpha and P0 values
  - Case 3: Close-loop power control
- Receiver impact

R1-165656 WF on multItiplke access scheme for NR Uplink NTT DOCOMO, Panasonic, LG

The document was presented by Ryosuke Osawa from NTT DOCOMO.

- Synchronous/UL grant-based orthogonal multiple access should be considered as the baseline UL transmission scheme at least for eMBB
  - Note: Synchronous means that timing offset between UEs is within cyclic prefix by e.g. timing alignment

Decision: The document is noted and agreed as follows:

Agreements:

- NR supports at least synchronous/scheduling-based orthogonal multiple access for DL/UL transmission schemes, at least targeting for eMBB
  - Note: Synchronous means that timing offset between UEs is within cyclic prefix by e.g. timing alignment

Wednesday

R1-165816 WF on considerations for multiple access LG Electronics, Ericsson

- For the study on multiple access,
  - Benefits of multiple access schemes should be assessed in considerations of other features especially MIMO aspect with larger number of antenna ports as below:
    - at least 8 at eNB side
    - at least 4 at UE side for eMBB usage scenario

Decision: The document is noted.

Not treated.

R1-163993 Non-Orthogonal Multiple Access Considerations for NR Samsung
R1-164036 Multiple access for UL small packets transmission Huawei, HiSilicon
R1-164037 LLS results for uplink multiple access Huawei, HiSilicon
R1-164178 Uplink non-orthogonal multiple access for NR access technology Intel Corporation
R1-164246 Discussion on scenarios and use cases for MA CATT
R1-164247 Performance on LLS of PDMA CATT
R1-164268 Grant-based and grant-free multiple access for mMTC ZTE
R1-164269 Contention-based non-orthogonal multiple access for UL mMTC ZTE
R1-164270 Receiver implementation for MUSA ZTE
R1-164346 MA for eMBB in mmWave spectrum Fiberhome Technologies Group
R1-164354 Underlay Common Control Channel for Unlicensed Spectrum Access and Underlay Low-Rate Data Channel for Licensed Spectrum Idaho National Laboratory
R1-164370 SLS evaluation methodology for grant-free based multiple access Huawei, HiSilicon
R1-164557 Initial LLS Evaluation Result for NoMA LG Electronics
R1-164558 Multiple Access scheme for eMBB LG Electronics
R1-164634 Instant uplink access Ericsson
R1-164672 NR multiple access Ericsson
R1-164688 RSMA Qualcomm Incorporated
R1-164689 RSMA and SCMA comparison Qualcomm Incorporated
R1-164876 Design target on multiple access schemes for NR Panasonic Corporation
R1-164889 Analytical Evaluation of Multiple Access and Preliminary Results CMCC
R1-165017 Scheduled TDMA-OFDMA for NRNokia, Alcatel-Lucent Shanghai Bell
R1-165020 Contention-based non-orthogonal multiple access with frequency hopping for mMTC uplink Nokia, Alcatel-Lucent Shanghai Bell
R1-165022 Uplink contention-based access in 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-165023 Scheduling framework and related requirements Nokia, Alcatel-Lucent Shanghai Bell
R1-165058 Performance Evaluation of Asynchronous UL NOMA INTERDIGITAL COMMUNICATIONS

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R1-165174	Uplink multiple access schemes for NR	NTT DOCOMO, INC.
R1-165175	Initial views and evaluation results on non-orthogonal multiple access for NR	NTT DOCOMO, INC.
R1-165410	Initial link level simulation results of new multiple access scheme	CATR
R1-165416	Overview of the proposed non-orthogonal MA schemes	Nokia, Alcatel-Lucent Shanghai Bell
R1-165435	Initial LLS evaluation results on multiple access schemes	Spreadtrum Communications
R1-165554	Proposed TR structure for Multiple Access Studies	Huawei, HiSilicon
R1-165619	Transceiver implementation and complexity analysis for SCMA	Huawei, HiSilicon

7.1.4 Numerology and frame structure for new radio interface

R1-165112 NR Numerology Design Principles Qualcomm Incorporated

The document was presented by Jing Jiang from Qualcomm and proposes the following Way Forward:

- In RAN1 #85, RAN1 could agree on the scaling methodology in frequency:
  - The subcarrier spacing for the NR scalable numerology should scale as
    - $f_{sc} = f_0 * 2^m$
    - where
      - f_0 is FFS
      - m is an integer chosen from a set of possible values
- In RAN1 #86, RAN1 could agree on the specific values of
  - f_0 and m

Decision: The document is noted.

R1-164692 Numerology and TTI multiplexing for NR Forward Compatibility Analysis Qualcomm Incorporated

- Proposal 1: NR should support multiplexing of services of different numerologies in the same carrier.
- Proposal 2: NR should support short subframes by scaling the number of symbols.
- Proposal 3: NR should support low latency services with short subframes by scaling up SCS (i.e., scaling down symbol duration).
- Proposal 4: scaled numerology should have multi-symbol unit aligned with the symbol boundary of the original numerology for efficient numerology multiplexing.
- Proposal 5: subframe interval and boundary should aligned irrespective of the underlying PHY numerology for efficiency and simplicity.
- Proposal 6: power of 2 symbols numerology should be considered jointly with NR frame structure, URLLC forward compatibility design.

Decision: The document is noted.

R1-164271 Overview of numerology candidates ZTE

The document was presented by Thorsten Schier from ZTE.

- Observation 1: Alt 1 (NCP) 15 kHz and Alt 3 17.07 kHz have similar performance, also for very long DS. Alt 3 outperforms Alt 1 when achieving low-latency subframes (0.125 ms) at very long DS.
- Observation 2: Mixed-radix DFT complexity is not more than 28% higher than FFT. Mixed-radix DFT provides additional flexibility.
- Observation 3: Alt 2-4 have better forward compatibility for a smooth evolution to fewer symbols per subframe.
- Proposal 1: A mixed-radix DFT approach should be adopted, so that a smooth introduction of future features and services that may require new unscaled CP durations is ensured, without changing the unscaled symbol durations or the frame structure.
- Observation 4: All numerology candidates offer co-existence with LTE and NB-IoT.
- Proposal 2: A numerology with 2^m symbols (m is an integer) per subframe is adopted in NR.
- Proposal 3: NR adopts numerologies based on Alt 3.

Decision: The document is noted.

R1-164031 Analysis and comparison on numerology candidates Huawei, HiSilicon

The document was presented by David Mazzarese from Huawei and provides the comparison of 15kHz family and 17.5kHz family summarized in Table4, and considering the performance in **Error! Reference source not found.**R1-164030] which shows 15kHz outperforms 17.5kHz family, 15kHz family subcarrier spacing is proposed for NR.
Discussion: Qualcomm does not agree with "For NR using 15kHz, there is no interference between NR and NB-IOT"
Decision: The document is noted.

Qualcomm suggested more offline discussion on:
How to achieve reduced latency?
How to achieve multiplexing efficiency?
How to align TTI/ symbol boundary
How to fix overhead for normal CP?

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R1-164622 **NR numerology Ericsson**

The document was presented by Stefan Parkvall from Ericsson.

- RAN1 concludes on alternative 1 (Subcarrier-spacing values include 15 kHz subcarrier-spacing (i.e., "LTE-based" numerology)) as the baseline for the NR numerology
- RAN1 concludes on scale factors N =2^n as the baseline for the NR numerology.

Decision: The document is noted.

R1-165439 **Views on numerology for NR** **NTT DOCOMO, INC.**

The document was presented by Fred Takeda from NTT DOCOMO.

- Observation 1: Possible subcarrier spacing is determined by f_0*2^m where m is an integer.
  - f_0=15kHz and m is an integer.
- Observation 2: Fixed CP overhead ratio for different subcarrier-spacing would be sufficient as normal CP operation.

The following table is proposed as a starting point.

	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Set 7	Set z
SC-spacing (kHz)	15	30	60	120	240	480	960	...
CC BW (MHz)	X	2X	4X	8X	16X	32X	64X	...
Symbol length (us)	66.67	33.33	16.67	8.33	4.17	2.08	1.04	...
CP-length (us)	4.69	2.34	1.17	0.59	0.29	0.15	0.07	...
SF length (ms)	TBD after identifying detailed scheduling operations in NR							
Frame length (ms)	Periodicity of fixed DL resources can be a starting value							
Note	At least it is necessary to cover X = 20, and it is beneficial to cover X=40 FFS further wider bandwidth							

Decision: The document is noted.

R1-165525 **Discussion on NR numerology** **KT Corp., Verizon Wireless**

The document was presented by Hyojin Lee from KT.

Proposal 1:

- *LTE based numerology including 15 kHz subcarrier-spacing should be the baseline for NR design*
- *Alternative proposals have to be justified based on concrete use cases and significant benefits in performance or implementation perspective*

Observation 1: Taking into account available BW for NR, there are some deployment cases that cannot be efficiently supported only with 2^m scaling values for subcarrier spacing

Observation 2:

- *The scalable way as agreed in RAN1#84bis would be beneficial for different carrier frequencies since a basic frame structure and design can be easily re-used*
- *However, it is quite difficult to find any reason why the scaling to support different carrier frequencies should be restricted in 2^m values.*

Observation 3:

- *Since the basic NR system operation would be for eMBB services in most cases, it would be a sufficient design requirement that subcarrier spacing values for URLLC and mMTC should be multiplies or divisors of the one for eMBB rather than 2^m scaling relationship*
- *More important design factors should be the requirements derived for different use cases in [TR 22.891] and [*TR 38.913*]*

Proposal 2: The scalable numerologies should be designed under the assumption of linear scaling values rather than being restricted in 2^m scaling values taking into account the following three aspects:

- *To efficiently utilize available 5G bandwidths*
- *To cover wide range of target frequency up to 100GHz*
- *To support multiple use cases in the same carrier frequency*

Decision: The document is noted.

R1-165517 **WF on scaling of subcarrier spacing in NR** **Samsung, Intel, KT Corp., Verizon Wireless, Fiberhome**

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- $f_{sc} = f_0 * M$ *(Alt. 2)* should be taken into account as the scaling method of subcarrier spacing in NR SI where $f_0 = 15$ *kHz.*
- Subcarrier spacing values to be studied in NR SI include at least
  - *{15, 30, 60, 75, 120, 150, 240, 300} kHz*

Decision: The document is noted.

Working assumption

- RAN1 concludes on alternative 1 (15 kHz) as the baseline design assumption for the NR numerology
- RAN1 concludes on scale factors N =2^n for subcarrier spacing as the baseline design assumption for the NR numerology.

Supported by Ericsson, MediaTek, Fujitsu, Panasonic, Nokia, ASB, LGE, Huawei, HiSilicon, NTT DOCOMO, Sharp, CATT, ETRI, ITRI
CMCC: object to the working assumption
Qualcomm: does not agree with 1st bullet
KT: this represents a majority's view, no consensus - should not be taken as a working assumption
Ericsson: it can always be revisited at next meeting if deemed necessary
NTT DOCOMO: if WA is to be rediscussed, should be wise to define a deadline for bringing any critical issues up – otherwise we enter in an endless discussion

Possible working assumption (CMCC, Qualcomm, KT)

- RAN1 concludes on scale factors N =2^n as the baseline design assumption for the number of OFDM symbols per 1ms

Continue offline: CMCC

Possible conclusions:

- If RAN1 finds issues about above WA including the following criteria, RAN1 should compare WA and "scale factors N = 2^n as the baseline design assumption for the number of OFDM symbols per 1 msec" by Wednesday
  - Design complexity
  - Compatibility of different numerology from time domain and frequency domain
  - Latency
  - Multiplexing efficiency
  - TTI/symbol boundary alignment
  - Overhead of Normal CP
  - Coexistence with NB-IoT and LTE
  - Scalable set of supportable CC BW

R1-165583 WF on Scalable Numerology Symbol Boundary Alignment Qualcomm, ZTE, ETRI, NEC, OPPO , Panasonic, DoCoMo, Deutsch Telecom, Convida Wireless,
Decision: The document is noted. Continue offline discussion until Wednesday

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Wednesday
R1-165821 WF on Scalable Numerology Symbol Boundary Alignment Panasonic, InterDigital, Ericsson, Fujitsu, NTT DOCOMO
Decision: The document is noted.

Possible agreements:

- In case of F0=15 kHz, with Fs=15 kHz symbol boundary of normal CP is aligned with LTE.
- For scaled numerology Fs = F0*M, in the case where Base numerology contains N symbols per ms and scaled numerology contains N*M symbols per ms
  - Each symbol length (including CP) of base numerology (w/ SCS = F0) equals the sum of the corresponding M symbols of scaled numerology (w/ SCS = Fs)
  - Each symbol may not necessarily be of the same length (e.g. in LTE numerology, symbol0 is long than symbol 1, 2, … 6)
  - Multiple CP durations per each numerology is not precluded:
    - For each CP family (NCP or ECP), each symbol length (including CP) of base numerology (w/ SCS = F0) equals the sum of the corresponding M symbols of scaled numerology (w/ SCS = Fs)
- Above is not related to synchronization among multiple transmitters like network synchronization, synchronization among UEs, different NR carrier bandwidth and so on.

Continue offline discussion until Thursday – Suzuki (Panasonic)

Thursday
R1-165886 WF on Scalable Numerology Symbol Boundary Alignment Panasonic, Intel, Samsung, NTT DOCOMO, Qualcomm, Huawei, Mediatek
Decision: The document is noted.

Working assumption:

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- In the case of subcarrier spacing 15 kHz and 14 symbols per 1ms, the following applies:
  - Baseline: Symbol boundary is aligned with LTE of normal CP

Agreement: For the numerology with 15 kHz and larger subcarrier spacing ,1 msec alignment is supported

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R1-165841 **WF on NR CP type Huawei, HiSilicon, Intel, LGE, CATT, IITH, CEWiT, Reliance-jio, Tejas Networks, Samsung, NEC, Sony, Fujitsu, Vodafone**

- Multiple CP types should be allowed for each NR subcarrier spacing

Discussion: Qualcomm → concern on complexity – why not start with 1CP, optimize it and then decide
Nokia: clearly RAN1 should concentrate on normal CP, should take design decisions that do not prevent using any future extended CP.
Erricsson: Agree with Nokia – should not preclude having multiple CPs
Huawei: believes the need for multiple CP is already there
Decision: The document is noted.

Possible agreement: Multiple CP types/lengths without having scaling subcarrier spacing should be allowed
Continue offline discussion until Thursday – David (Huawei)

Thursday

R1-165878 **WF on further step on numerology study Huawei, CMCC, National Instruments, Ericsson, Orange, Vodafone, Panasonic**

- RAN1 should investigate the impact of supporting the following non-mutually exclusive options:
  - Multiple CP lengths by scaling subcarrier spacing using a single CP type/option, and enabling OFDM symbol alignment among scaled numerologies (R1-165821)
  - Multiple CP types/options without scaling subcarrier spacing (R1-165841)
  - Multiple network configuration options where the system can operate with different CP overheads (R1-165719)

Decision: The document is noted.

R1-164674 **see 7.1.1**
R1-164632 **Flexible bandwidth in NR Ericsson**
Decision: The document is noted.

Agreements:

- NR should support of flexible NW and UE channel bandwidth
- FFS: NR carrier bandwidth should consider to allow efficient unlicensed spectrum access
- The NR physical-layer design should allow for fine granularity in terms of NR carrier bandwidth
- The NR physical-layer design should be such that devices with different bandwidth capabilities can efficiently access the same NR carrier regardless of the NR carrier bandwidth
  - FFS: minimum bandwidth
- FFS: There should not be an assumption that devices necessarily support the same set of bandwidths for transmission and reception
- FFS: There should not be an assumption that the network carrier bandwidth is necessarily the same for downlink and uplink

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Wednesday

R1-165731 **Way forward on Numerology LG Electronics, NTT DOCOMO, Sprints, LGU+**
Decision: The document is noted.
R1-165660 **WF on Scalable NCP Qualcomm Incorporated, ZTE**
Decision: The document is noted.
R1-165719 **Discussion on frequency-domain initiated numerology and time-domain initiated numerology CMCC**
Decision: The document is noted.

Possible conclusions:

- RAN1 will evaluate CP length(s) for different deployments scenarios and different services
- RAN1 should carefully make decision on such kind of key parameters and design principle than dependent on more studies and evaluation. Especially full comparison from different aspects should be done to guarantee we are on the right way. Based on above observation. we propose to do some comparison from following aspects(not limited to):
  - Design complexity and future design effort
  - Overall performance
  - Compatibility of different numerology from time domain and frequency domain

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- Multiplexing efficiency
- Latency
- Coexistence with NB-IoT and LTE
- Scalable set of supportable CC BW

Continue offline discussion.

Thursday

R1-165842 Proposals for evaluation of CP requirements in NR CMCC

- To evaluate what is the minimal CP length in NR considering existed knowledge on delay spread
  - Scaled CP and Scaled numerologies Vs Unscaled CP and Scaled numerologies
  - Unscale CP assumes two values for comparison
    - Comparable NCP used in LTE, e.g., for 2^N SCS scheme, 4.71us, for 2^N OS scheme 5.36us
    - Half of Comparable NCP used in LTE, e.g., for 2^N SCS scheme, about 2.36us, for 2^N OS scheme about 2.68us

Decision: The document is noted.

Conclusion: For CP based scheme, companies are encouraged to evaluate/investigate necessary CP lengths for different numerologies

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R1-165734 WF on subcarrier spacing in NR Verizon Wireless, KT Corp., Reliance-jio, CHTTL, Samsung, Intel, Potevio, Fiberhome, IITH, CEWiT, Tejas Neworks

- Working Assumption discussed on Monday should be revisited to resolve the issues identified with 2^m scaling
- Take the following as the revised working assumption on subcarrier spacing:
  - *Working assumptions*
    - *RAN1 concludes on alternative 1 (15 kHz) as the baseline design assumption for the NR numerology*
    - *RAN1 concludes on scale factors N =2^n for subcarrier spacing as the baseline design assumption for the NR numerology*
    - *RAN1 should include the subcarrier spacing {75} kHz for different CC BW support*

Discussion: Objection from Qualcomm, Nokia, ASB, Huawei, HiSilicon, Fujitsu adding the third bullet in the WA

Decision: The document is noted.

Thursday

R1-165891 WF on subcarrier spacing in NR Verizon Wireless, KT Corp., Reliance-jio, CHTTL, China Telecom, Samsung, Intel, Potevio, Fiberhome, IITH, CEWiT, Tejas Neworks, Straight Path, ITL, WILUS

- *Working assumptions*
  - *RAN1 concludes on alternative 1 (15 kHz) as the baseline design assumption for the NR numerology*
  - *RAN1 concludes on scale factors N =2^n for subcarrier spacing as the baseline design assumption for the NR numerology*
  - *RAN1 include 75 kHz for subcarrier spacing as the additional baseline design assumption for the NR numerology*

Decision: The document is noted.

Conclusion: RAN1 will continue investigations on how to achieve effective use for variable bandwidths until the next meeting

Observations: Some companies proposed followings

- introducing a complementary scale factor leading to subcarrier spacing of 75 kHz for support of 100 MHz (in R1-165891)
- f0 = 17.5 kHz subcarrier spacing (R1-165112)
- f0 = 17.07 kHz subcarrier spacing (R1-164271)

R1-165807 Way forward on timing relations for NR Frame Structure CMCC, CATT, OPPO, MediaTek, Lenovo

Decision: The document is noted. Revised in:

R1-165871 Way forward on timing relations for NR Frame Structure CMCC, CATT, OPPO, MediaTek, Lenovo, Huawei, HiSilicon

- NR should at least support common design of timing relation for TDD and FDD (i.e., duplex agnostic timing relation design) in the following aspects,
  - Timing relations between DL assignment and the corresponding DL data transmission
  - Timing relations between DL data and the corresponding DL data acknowledgement
  - Timing relations between UL grant and the corresponding UL data transmission
  - Timing relations between UL data and the corresponding UL data transmission
- The common design shall consider, e.g.,
  - The indication of the timing relation, e.g., DCI and/or RRC and/or others, shall be duplex agnostic.
- Note: this does not preclude any optimization for either TDD only or FDD only

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Decision: The document is noted.

Agreements:
- RAN1 strives for maximizing commonality between TDD and FDD
  - It is preferable that mechanisms to indicate the timing relation are duplex agnostic
  - Note: This does not preclude any optimization either for FDD only or TDD only

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R1-165456 Summary of email discussion on frame structure Qualcomm Incorporated

The document was presented by Joseph Soriaga from Qualcomm.

- Potential Agreement 1: NR frame structure should defined using two basic types of time intervals: time interval A which would be expressed as multiple of symbols, and time interval B which is expressed as absolute time (nominally 1ms). An integer scaling relationship between these two time intervals may follow from the numerology for subcarrier spacing.
- Observation 1: When the time interval A is shortened/extended, the frequency granularity is also scaled to wider/narrower. One atomic block size is defined dimensioned by one time interval A and one frequency granularity.
- Potential Agreement 2: An atomic block size is basically common between paired and unpaired spectrum. Specific optimization for paired and unpaired spectrum is not precluded.
- Observation 2: There was commonality in defining time interval A to have up to one switch between DL and UL.
- Potential Agreement 3: Consideration of baseline frame structures in Table 1, but FFS multiple gaps within time interval A with respect to forward compatibility.
- Potential Agreement 4: The RS used to demodulate a data transmission is located FFS near before and/or within a time interval A. FFS whether a time interval A always has the RS used to demodulate a data transmission.
- Potential Agreement 5: The NR design should strive to reduce the time between the assignment to the corresponding data and the time between the data to the corresponding acknowledgement. FFS whether the time can be short enough so that the exchange is confined within time interval A.
- Potential Agreement 6: The scaling of time interval A is realized by the changing the number of the symbols without changing the numerology, or by the keeping the number of the symbols with changing the numerology.

Decision: The document is noted.

R1-165685 WF on Phase Noise Modeling Nokia, Alcatel-Lucent Shanghai Bell, NTT DoCoMo, Samsung, Qualcomm, Ericsson, Intel, InterDigital

PN model should be developed for evaluation of NR systems for above 6GHz with the following principles

- Proposal #1:
  - Phase noise model for UE should be considered for the evaluation by default.
  - Implementation cost, complexity and power consumption at the UE should be taken into account.
  - The PN modelling in eNB is FFS.
- Proposal #2:
  - Realistic PN model should consider total oscillator PSD including the impact of reference clock, loop filter noise and VCO sub-components. (e.g. PLL-based model, multi-pole/zero model)
  - Each company should provide the model and the parameters used for the evaluation.
- Proposal #3:
  - The oscillator PSD level increases by 20dBc/Hz per decade of increase of the carrier frequency. (Baseline)
  - A different parameter set of phase noise model can be defined for specific target frequency.
- Proposal #4:
  - Companies are encouraged to provide link level evaluation result with the phase noise model. Following phase noise models are provided as examples.
    - UE model in R1-164041
    - Proposed WF in R1-165005
    - Model A in R1-163984
    - mmMagic high and low model
  - Other phase noise model is not precluded.
  - Companies should provide which phase noise model is applied for the evaluation.

Decision: The document is noted and modified as follows:

Agreements:
- Companies should use following PN model principles for evaluation of NR for above 6GHz
  - Phase noise model for UE should be considered for the evaluation by default.
  - Implementation cost, complexity and power consumption at the UE should be taken into account.
  - The PN modelling in TRP is FFS.

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- Realistic PN model should consider total oscillator PSD including the impact of reference clock, loop filter noise and VCO sub-components. (e.g. PLL-based model, multi-pole/zero model)
- Each company should provide the model and the parameters used for the evaluation.
- The oscillator PSD level increases by 20dB per decade of increase of the carrier frequency as a baseline to scale PSD level
- A different parameter set of phase noise model can be defined for specific target frequency.
- Companies are encouraged to provide link level evaluation result with the phase noise model. Following phase noise models are provided as examples which are captured in R1-165685 (in page 5 – 8)
  - UE model in R1-164041
  - Proposed WF in R1-165005
  - Model A in R1-163984
  - mmMAGIC high and low model
- Other phase noise model is not precluded.
- Companies should provide which phase noise model is applied for the evaluation.

R1-165575 Way Forward On Frame Structure Qualcomm, Ericsson, Panasonic, NTT Docomo, ZTE, Convida, Nokia, ASB, Sony, Intel

The document was presented by Joseph Soriaga from Qualcomm.

- At least the following is studied in NR in order to reduce decoding latency
  - RS used to demodulate a data transmission is located at the beginning of the time interval to which the data and associated RS for demodulation is physically mapped

Discussion: Also supported by InterDigital.
Decision: The document is noted, agreed as follows:

Agreements:

- At least the following is studied for NR in order to reduce decoding latency
  - RS used to start to demodulate a data transmission is located at the beginning of the time interval to which the data and associated RS for demodulation is physically mapped
- Other additional RS design associated with data demodulation is not precluded

R1-165669 Way Forward On Frame Structure Qualcomm, OPPO, MediaTek, Intel, CATT, DOCOMO, InterDigital, Samsung, Sony, ZTE, Ericsson, Panasonic, ITRI, ETRI

- At least the following should be supported for NR
  - A time interval X which can contain one or more of the following
    - DL transmission part
    - Guard
    - UL transmission part
  - Dynamic and Semi-static operations are studied
  - Furthermore, the following is supported
    - The DL transmission part of time interval X to contain downlink control information and/or downlink data transmissions and/or reference signals
    - The UL transmission part of time interval X to contain uplink control information and/or uplink data transmissions and/or reference signals
  - FFS length(s) of time interval X
  - Note: The usage of DL and UL does not preclude other deployment scenarios e.g., sidelink, backhaul, relay

Decision: The document is noted and modified as follows:

Agreements:

- At least the following should be supported for NR in a frequency portion
  - A time interval X which can contain one or more of the following
    - DL transmission part
    - Guard
    - UL transmission part
  - FFS which combinations are supported and whether they are indicated dynamically and/or semi-statically
  - Furthermore, the following is supported
    - The DL transmission part of time interval X to contain downlink control information and/or downlink data transmissions and/or reference signals
    - The UL transmission part of time interval X to contain uplink control information and/or uplink data transmissions and/or reference signals
  - FFS length(s) of time interval X
  - FFS: other characteristics of time interval X
  - Note: The usage of DL and UL does not preclude other deployment scenarios e.g., sidelink, backhaul, relay

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R1-165662 **WF on NR frame structure** **Samsung, Mediatek, Intel, NTT DOCOMO, CMCC, Panasonic, Sony, ITRI, Interdigital, LG Electronics**

- At least the following is supported for NR frame structure
  - Following timing relationships are indicated to a UE dynamically and/or semi-statically
    - Timing relationship between DL data reception and corresponding acknowledgement
    - Timing relationship between UL assignment and corresponding UL data transmission
  - Following timing relationship is FFS whether fixed and/or dynamically and/or semi-statically indicated
    - Timing relationship between DL assignment and corresponding DL data reception
  - For above two sub-bullets
    - Potential values for each timing relationship has to be studied further considering e.g., UE processing capability, gap overhead, UL coverage, and etc.
    - Default value, if any, for each timing relationship is FFS.

Decision: The document is noted and the WF is agreed.

R1-165700 **Way Forward on Frame Structure Timing Relations** **Ericsson, Qualcomm, ZTE, NTT DOCOMO**
Decision: The document is noted.
R1-165739 **NR Frame Structure Timing Relations** **Ericsson**
Decision: The document is noted.

Agreements:

- NR design should strive at least to enable the possibility for
  - Corresponding acknowledgement reporting shortly (in the order of X μs) after the end of the DL data transmission
  - Corresponding uplink data transmission shortly (in the order of Y μs) after reception of UL assignment
  - Note: may depend on e.g. UE capability/category, payload size, etc
  - FFS: X and Y in the order of a few tens of or hundreds of micro sec is feasible
- Other mechanisms/configurations in addition to fast/short corresponding acknowledgement are needed
  - For example to provide coverage or enable TD-LTE coexistence
- Note: RAN1 will continue investigations about UE complexity, implementation processing time, interleaving applicability

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Thursday
R1-165818 **Way Forward on frame structure for NR** **LG Electronics, CATT, ETRI, Lenovo**
Decision: The document is noted. Revised in:
R1-165896 **Way Forward on frame structure for NR** **LG Electronics, CATT, ETRI, Lenovo**
Decision: The document is noted.
R1-165931 **Way Forward on time interval for NR** **LG Electronics, CATT**

- Following type of time interval is needed in NR
  - UE-common time interval
    - This is to be known by the UE for access to network for a given numerology
    - FFS on the length of this time interval
    - FFS on the relationship between this time interval and the time interval X, in terms of the length

Decision: The document is noted.

R1-165840 **Way Forward on NR frame structure with asynchronous UL HARQ** **ZTE, Qualcomm, Ericsson, DOCOMO, ETRI**

- NR should at least support asynchronous hybrid ARQ in the UL to avoid fixed timing relationship between initial transmission and re-transmission

Decision: The document is noted and modified as follows:

Agreement: NR should support at least asynchronous hybrid ARQ in the DL and UL to avoid fixed timing relationship between initial transmission and re-transmission

R1-165872 **WF on minimum HARQ Timing** **LG Electronics, Panasonic**
Decision: The document is noted. Revised in:
R1-165887 **WF on minimum HARQ Timing** **LG Electronics, Panasonic, Qualcomm, NTT DOCOMO**
Decision: The document is noted, modified as follows:

Agreements:

- NR design should strive to enable the possibility for
  - Corresponding retransmission shortly (in the order of Z μs) after the end of acknowledgement reporting

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- FFS: Z in the order of a few tens of or hundreds of micro sec is feasible

R1-165955 **WF on time interval X Huawei, HiSilicon, Qualcomm, Nokia, ASB**

- At least the following combinations with time order for time interval X should be supported
  - Combination 1: DL transmission part, a possible guard
  - Combination 2: A possible guard, uplink transmission part
  - Combination 3: A DL transmission part, a guard, and an UL transmission part

Decision: The document is noted and modified as follows:

Possible agreements:

- At least the following combinations for time interval X should be supported
  - Combination 1: DL transmission part, possible guard(s)
  - Combination 2: Possible guard(s), uplink transmission part
  - FFS: Combination 3: A DL transmission part, a guard, and an UL transmission part

Continue offline discussion until Friday – (Huawei)

Friday

R1-166013 **WF on time interval X Huawei, HiSilicon, Qualcomm, Nokia, ASB**

Decision: The document is noted.

R1-165877 **WF on wireless relay/backhaul for NR Samsung, AT&T, Ericsson**

Decision: The document is noted.

R1-165902 **WF on wireless backhaul for NR Samsung, AT&T, Ericsson, Intel, IITH, CEWiT, Tejas Networks, Reliance-jio, Straight Path**

- NR should allow for efficient same frequency operation between the access link and backhaul link.
- NR should also allow for efficient operation when the backhaul link and access link are on different frequencies. This includes:
  - Operation of backhaul link and access link on different frequencies in the same band
  - Operation of backhaul link and access link in different bands
- Note: The term 'backhaul link' does not make any assumption on NR RAN architecture design options

Decision: The document is agreed.

Friday

R1-165990 **WF on Frame Structure and Evaluation Qualcomm, Huawei, HiSilicon, NTT DOCOMO, Ericsson**

Decision: The document is noted. Also supported by ZTE, Panasonic. Revised in:

R1-166027 **WF on Frame Structure and Evaluation Qualcomm, Panasonic, NTT DOCOMO, KT Corp, MediaTek, Intel**

Decision: The document is noted and modified as follows:

Agreements:

- At least the following time domain structures should be studied/evaluated for NR
  - DL transmission region (containing data assignments and data), guard region, UL transmission region (containing UCI)
  - DL transmission region (containing data assignments), guard region, UL transmission region (containing data, UCI)
  - Other structures not precluded
  - Note: there is no assumption between the relationship of assignments and data in the above
  - FFS: there can be guard region after the uplink transmission region.
- FFS: Study candidate solutions where 1 structure spans at most a time interval of 1 ms
- FFS: Metrics for study/evaluation
- Note: This does not preclude the same structure could span multiple 1 msecs

Not treated.

R1-163994	Discussions on control signaling for NR	Samsung
R1-163995	Discussions on reference signal design for NR	Samsung
R1-163996	Discussion on the base subcarrier spacing for NR	Samsung
R1-163997	Cell search for NR: design consideration	Samsung
R1-163998	Proposed set of numerologies for NR	Samsung
R1-163999	Discussion on different scaling methods for NR subcarrier spacing	Samsung
R1-164000	Unified framework for NR physical layer	Samsung

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

R1-164001	Framework for multiplexing verticals in NR	Samsung
R1-164002	Design aspects of URLLC for NR	Samsung
R1-164003	Dynamic TDD for NR	Samsung
R1-164004	Discussion on TTI, subframe and signaling timing for NR	Samsung
R1-164005	Support of wireless relay for NR	Samsung
R1-164006	Design aspects of mMTC for NR	Samsung
R1-164030	Evaluation of scalable numerology proposals	Huawei, HiSilicon
R1-164032	Discussion on frame structure for NR	Huawei, HiSilicon
R1-164179	Subcarrier spacing and scaling for new RAT	Intel Corporation
R1-164180	Low Latency Frame Structure Design for NR	Intel Corporation
R1-164181	NR Operation in Unlicensed Spectrum	Intel Corporation
R1-164248	NR frame structure design	CATT
R1-164249	Discussion of NR numerology	CATT
R1-164261	Forward compatibility of numerology and frame structure design	ZTE
R1-164272	Performance evaluation of numerology candidates	ZTE
R1-164273	Frequency multiplexing of different numerologies	ZTE
R1-164274	Frame structure for NR	ZTE
R1-164275	NR frame structure for unlicensed spectrum	ZTE
R1-164276	Discussions on HARQ operation for NR	ZTE
R1-164330	NR sub-carrier spacing	Fujitsu
R1-164331	TDD frame structure with mixed numerology	Fujitsu
R1-164332	NR Frame structure considerations for low latency TDD operation	Fujitsu
R1-164333	Discussion on flexible/dynamic TDD	Fujitsu
R1-164347	Numerology for 5G NR	Fiberhome Technologies Group
R1-164380	Frame Structure Design Considerations for Bands above 6 GHz	Huawei, HiSilicon
R1-164381	Impact of directional transmission on NR numerology for high frequency bands	Huawei, HiSilicon
R1-164472	Frame structure supporting flexible parameter allocations	Guangdong OPPO Mobile Telecom.
R1-164482	Considerations on the design of frame structure for NR	NEC
R1-164486	Subcarrier spacing and other parameters for numerology	NEC
R1-164560	Discussion on frame structure for NR	LG Electronics
R1-164561	Support different numerology and different usage scenarios	LG Electronics
R1-164562	Consideration of Flexible and Full duplex operation in NR design	LG Electronics
R1-164590	Discussion on numerology sets	Spreadtrum Communications
R1-164591	Discussion on frame structure	Spreadtrum Communications
R1-164621	On a 30kHz subcarrier spacing option for NR	Ericsson
R1-164627	Hybrid-ARQ acknowledgements for NR	Ericsson
R1-164628	Frame structure for NR	Ericsson
R1-164630	Performance difference between 60 and 75 kHz subcarrier spacing	Ericsson
R1-164631	Duplex schemes for NR	Ericsson
R1-164652	Frame structure design for new radio interface	Lenovo (Beijing) Ltd
R1-164657	Discussion on frame structure design for NR	Sony
R1-164658	Discussion on numerology design for NR	Sony
R1-164665	Frame structure for New Radio	INTERDIGITAL COMMUNICATIONS
R1-164666	Numerology for New Radio	INTERDIGITAL COMMUNICATIONS
R1-164690	NB-IOT Coexistence Analysis for NR Numerology	Qualcomm Incorporated
R1-164691	NR numerology design and evaluation for long delay spread channels	Qualcomm Incorporated
R1-164693	NR sampling rate related numerology considerations for eMBB and mMTC	Qualcomm Incorporated
R1-164694	Frame structure requirements	Qualcomm Incorporated
R1-164695	Candidate frame structures	Qualcomm Incorporated
R1-164723	Numerology and Frame Structure for NR-Unlicensed	Huawei, HiSilicon
R1-164870	Discussion on numerology for NR	ETRI
R1-164871	Frame structure for new radio interface	ETRI
R1-164890	Discussion on the frame structure design for new radio	CMCC
R1-164915	Transient period on NR uplink frame structure design	Panasonic Corporation
R1-164973	NR frame structure considering coexistence with TDD LTE	SoftBank Corp.
R1-164985	Discussion on the multiplexing of different numerologies	Panasonic
R1-165024	Flexible numerology for 5G	Nokia, Alcatel-Lucent Shanghai Bell
R1-165025	Comparison of different numerology scaling principles	Nokia, Alcatel-Lucent Shanghai Bell
R1-165026	Comparison of different subcarrier spacings	Nokia, Alcatel-Lucent Shanghai Bell
R1-165027	Basic frame structure principles for 5G	Nokia, Alcatel-Lucent Shanghai Bell
R1-165028	URLLC U-plane latency analysis	Nokia, Alcatel-Lucent Shanghai Bell
R1-165029	Main components for forward compatible frame structure design in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-165030	On the unlicensed band operation in NR	Nokia, Alcatel-Lucent Shanghai Bell
R1-165031	On the wireless relay operation in NR	Nokia, Alcatel-Lucent Shanghai Bell

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R1-165055 Discussion on Frame Structure for NR Cohere Technologies
R1-165083 Consideration on URLLC in NR frame structure ZTE
R1-165107 Numerology and Frame Structure for NR Motorola Mobility
R1-165162 On Numerology for New Radio Access Technology MediaTek Inc.
R1-165163 Flexible Frame Structure for New Radio Access Technology MediaTek Inc.
R1-165176 Discussion on frame structure for NR NTT DOCOMO, INC.
R1-165178 Views on domodulation RS design for NR access technology NTT DOCOMO, INC.
R1-165217 Consideration on frame structure for NR Beijing Xiaomi Mobile Software
R1-165242 On Frame Structure for NR Innovative Technology Lab Co.
R1-165285 Bidirectional frame structure for imparity CCFD scheme III
R1-165291 Discussions on the numerology and frame structure design for NR CATR
R1-165311 Considerations on frame structure for NR KT Corp.
R1-165316 Scalable numerology for New RAT Sharp
R1-165371 Discussion of Numerology for NR Convida Wireless LLC
R1-165431 Initial Evaluation Result for NR Numerology LG Electronics
R1-165436 Discussions on reference signal design for NR Samsung
R1-165811 WF on Frame Structure and Control Interference Qualcomm
R1-165833 Mixed Numerology in an OFDM System Ericsson
R1-165925 WF on frame structure for NR LG Electronics, CATT
R1-166032 Way Forward on Ack/Nack feedback of DL HARQ for NR ZTE, ZTE Microelectronics, Ericsson, Qualcomm, NTT DOCOMO

7.1.5 Channel coding and modulation for new radio interface

R1-165945 Chairman's Notes of Agenda Item 7.1.5 on Ch_Coding Ad-hoc chair (Nokia)
The document was presented by Matthew Baker from Nokia and provides the outcomes of the session.
Decision: The document is endorsed. Contents incorporated below.

7.1.5.1 Channel coding

R1-164245 Discussion on link-level evaluation assumptions for channel coding CATT

Comparisons
General
R1-165641 Comparison of coding schemes for NR Intel Corporation
Revision of R1-164182
R1-164277 Evaluation on performance and complexity of channel coding for NR ZTE
R1-164704 Channel coding evaluation assumptions - performance and complexity Qualcomm Incorporated
R1-164564 Performance and complexity comparison of existing Turbo and LDPC codes LG Electronics

eMBB
R1-164812 Preliminary evaluation results on new channel coding scheme for NR - LDPC code for high throughput Samsung
R1-164360 Analysis of Candidate Code Types for Long Block Length Ericsson
R1-164377 Performance of channel coding schemes for eMBB scenario Huawei, HiSilicon
R1-165060 Performance Evaluation of Channel Coding for eMBB INTERDIGITAL COMMUNICATIONS
R1-165357 Performance of eMBB channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell
R1-165360 Selection of the eMBB channel coding scheme Nokia, Alcatel-Lucent Shanghai Bell

R1-165657 WF on channel coding for eMBB Nokia, ASB
Proposal:
- Conclusion:
  - At least LDPC and Polar can support the high code rate and high throughput scenarios
- Further study:
  - Study further whether modified Turbo or Polar codes can satisfy the high code rate and high throughput scenarios; working assumption may be revisited if so
  - Implementation details should be provided for the decoding algorithms used in the simulation results for other eMBB coding candidates, i.e. Turbo and Polar
    - E.g. : Survey on the existing implementation efforts

R1-165637 Way Forward on Channel Coding Scheme for New Radio Samsung, Nokia, Qualcomm, Intel, ZTE
Also supported by Sharp
Proposed conclusions:
- All candidate channel coding schemes for eMBB application show comparable link performance in most cases

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- Observations on LTE turbo code for high code rates
  - LTE turbo code requires higher decoder computational complexity compared to LDPC code
  - LDPC code is superior to LTE turbo code in terms of latency and high data throughput
  - ~~LTE turbo code starts generating error floor between BLER=10^{-2} and 10^{-3} for high code rates and for some large information block lengths (e.g. some sizes ≥1000 bits)~~
- ~~LDPC code can be designed to meet the flexibility required for application scenarios in NR systems~~

Observations:
- At least in AWGN channels:
  - For large information block sizes, all candidate channel coding schemes show comparable link performance
- Further study is required on all potential coding schemes in order to determine which coding scheme(s) should be supported, including:
  - Implementation details should be provided for the decoding algorithms used in the simulation results, e.g. survey on the existing implementation efforts

FFS:
- At least in AWGN channels:
  - [For small information block sizes, performance of Polar codes is comparable to or better than other candidate schemes depending on the Polar decoding technique and code rate]
- [At least LDPC can support the high code rate and high throughput scenarios]
- [At least Polar codes can support the high code rate and high throughput scenarios]
- Compared to LTE turbo code:
  - [At high code rates and high throughputs, LTE turbo code requires higher decoder computational complexity compared to LDPC code]
  - [Considering all code rates and all information block sizes and HARQ requirements, LTE turbo code has comparable decoder computational complexity compared to LDPC code]
- [Flexibility requirements and feasibility]

R1-165598 WF on small block length Huawei, HiSilicon, Interdigital, Mediatek, Qualcomm
Proposal:
- Observation - From the evaluation results
  - TBCC and polar codes show best performance for (K=20,40)
  - For K larger than 100 and lower than 1000, polar outperforms TBCC for all choices of code rate and list-size
- Proposal
  - At least for mMTC and URLLC, For small information block lengths ~~(e.g. 200 bits)~~, at least Polar codes and TBCC Codes are considered as candidate schemes.
    - FFS what is meant by "small"
  - Further evaluation of performance and complexity/latency needs to be done

R1-165726 Code type for small info block length in NR Ericsson, Nokia, ASB
Proposal:
- Observation
  - For short info block lengths and low code rate, TBCC and Turbo code perform well compared to LDPC and Polar codes
- Proposal
  - Baseline ~~C~~channel code type for short info block lengths (including at least: DL control channel and mMTC DL) in NR is tail-biting convolutional code (TBCC)
    - Can be revisited if problems are identified

R1-165741 WF on further study of complexity of channel code LG, Ericsson, Orange
Agreement:
As one potential input to the decisions on channel coding:
- Companies are encouraged to bring evaluations of the complexity of channel coding / HARQ schemes including at least:
  - Energy efficiency (J/bit)
  - Area efficiency (Gbps/mm^2)
- FEC complexity supporting the full range of info block lengths and code rates with reasonable (details FFS) granularity should be compared instead of single info block length with some code rate
  - Companies should provide details of the range of info block lengths and code rates for which their complexity evaluations are conducted

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R1-165959 WF on channel coding simulation data sharing Qualcomm
Agreement:
- Include file format of results with contribution
  - Use excel file template provided in ExampleResults.xlsx
  - Multiple columns for
    - QAM, Rate, Info. Blocklength, Es/N0, Eb/N0, BLER
  - Separate tab to provide context
    - Contribution#, name of code, decoder implementation, #iterations or list size, brief details of code construction, brief details of rate matching algorithm, #CRC bits, and other parameters
    - The referenced accompanying contribution should provide enough details to enable other companies to repeat the simulations
- Companies encouraged to submit with their contribution for RAN1 #86

mMTC, URLLC
R1-164357 Analysis of Candidate Code Types for Short Block Length Ericsson
R1-164356 Performance Evaluation of TBCC and Polar Codes Ericsson
R1-164378 Performance of channel coding schemes for mMTC and URLLC scenarios Huawei, HiSilicon
R1-165059 Performance Evaluation of Channel Coding for URLLC and mMTC INTERDIGITAL COMMUNICATIONS

R1-165358 Performance of mMTC and URLLC channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell
R1-165359 Latency considerations for URLLC channel coding candidates Nokia, Alcatel-Lucent Shanghai Bell

R1-164008 Preliminary evaluation results on new channel coding scheme for NR Samsung
R1-164009 Discussion on throughput, latency for new channel coding scheme for NR Samsung
R1-164040 On latency and complexity Huawei, HiSilicon
R1-164186 Performance evaluation of coding schemes for NR Intel Corporation
R1-164279 Throughput and latency analysis on new channel coding candidates for NR ZTE
R1-164358 Performance Evaluation of Turbo Codes and LDPC Codes at Lower Code Rates Ericsson
R1-164359 Performance Evaluation of Turbo Codes and LDPC Codes at Higher Code Rates Ericsson
R1-164563 Discussion on channel coding scheme considering NR KPIs LG Electronics
R1-164592 Simulation results of Turbo and Polar codes Spreadtrum Communications
R1-165036 Impact of Number of Iterations in Decoding Turbo and LDPC codes Ericsson Inc.
R1-165284 Channel Coding for NR NTT DOCOMO, INC.

LDPC Details and Performance
R1-164697 LDPC design overview Qualcomm Incorporated
R1-165409 Consideration on LDPC codes for NR ZTE
Revision of R1-164278

R1-164007 Flexibility of LDPC - Length, Rate and IR-HARQ Samsung
R1-164183 LDPC code design for NR Intel Corporation
R1-164250 Performance evaluation of non-binary LDPC codes CATT
R1-164253 Performance evaluation of binary LDPC codes CATT
R1-164698 LDPC - Performance evaluation Qualcomm Incorporated
R1-164813 Design of LDPC code for high throughput Samsung
R1-165164 Discussion on LDPC Code Design and Performance Evaluation MediaTek Inc.
R1-165399 Consideration on LDPC HARQ Combining and Coding MediaTek

R1-165643 WF on LDPC schemes for NR ZTE, ZTE Microelectronics, Nokia, Qualcomm, InterDigital, MediaTek, Intel, Samsung
Also supported by Sharp
Agreement:
- For the purpose of study and comparisons, quasi-cyclic like LDPC codes are defined as follows:
  - The Parity check matrix of Quasi-cyclic like LDPC Codes is defined at least by a matrix H of size $(mb \times z) \times (nb \times z)$, which consists of sub-block matrices of size $z \times z$, where each sub-block matrix is composed by circularly shifted matrices or zero matrices. Wherein, mb, nb and z are integers larger than 1.
    - The values of mb, nb and z are FFS.
- Companies providing evaluations or proposals for LDPC codes are encouraged to show how:
  - Multiple code rates and multiple code sizes would be supported,
  - Suitable granularity of information block size and code rate would be supported,
  - How to support HARQ with/without IR.

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Polar Coding Details and Performance

R1-164039 Polar codes - encoding and decoding Huawei, HiSilicon
R1-164184 Polar code design for NR Intel Corporation
Note that the curves for L=8 and L=32 are indicated the wrong way round in Fig 2

R1-164185 Polar code constructions for evaluations Intel Corporation
R1-164375 Evaluation of polar codes for eMBB scenario Huawei, HiSilicon
R1-164565 Discussions on polar code design LG Electronics
R1-164699 Polar code design overview Qualcomm Incorporated
R1-164700 Polar - Performance evaluation Qualcomm Incorporated
R1-165165 Discussion on Polar Code Design and Performance MediaTek Inc.

Turbo coding Details and Performance

R1-164251 Performance evaluation of binary turbo codes with low complexity decoding algorithm CATT
R1-164635 Improved LTE turbo codes for NR ORANGE
R1-164361 Turbo Code Enhancements Ericsson

R1-164252 Performance evaluation of non-binary turbo codes CATT

R1-165792 WF on turbo coding LG, Ericsson, CATT, Orange
Proposed observation:
- Turbo codes in general ~~provide~~ show potential for full flexibility of all code rates and all information block sizes, e.g. from 40 bits to 8192 bits

Outer coding

R1-164280 Consideration on outer code for NR ZTE
R1-164667 Outer erasure code for efficient multiplexing INTERDIGITAL COMMUNICATIONS
R1-164703 Outer erasure code use cases and evaluation assumptions Qualcomm Incorporated

R1-165954 WF on Outer Coding ZTE
Revisit at RAN1#86.

TBCC

R1-164701 TBCC design overview Qualcomm Incorporated
R1-164702 TBCC-Performance evaluation Qualcomm Incorporated

7.1.5.2 Modulation

R1-164653 Considerations for non-uniform constellations for NR Sony
R1-164187 Modulation schemes for New RAT Intel Corporation
R1-164626 On modulation schemes for NR Ericsson
R1-164705 NR modulation requirements Qualcomm Incorporated
R1-165061 Evaluation of Spatial Modulation for New Radio INTERDIGITAL COMMUNICATIONS

R1-164706 Evaluation assumptions for NR modulation schemes Qualcomm Incorporated
R1-165361 Digital Modulation for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-164566 Maximum Supported Modulation Order for above 6GHz LG Electronics

R1-165718 WF on baseline modulation schemes for NR study LG, Intel, Nokia, ASB
R1-165919 WF on modulation for NR InterDigital

7.1.6 Multi-antenna scheme for new radio interface

Discuss initial views on multi-antenna scheme including enhanced massive MIMO analog/digital/hybrid beam-forming

R1-164013 **Framework for beamformed access** **Samsung**
- *Observation 1: Relying solely on digital precoding to compensate for the additional path-loss in higher frequencies will lead to excessive implementation burden.*

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- *Proposal 1: Adopt hybrid beamforming as a baseline MIMO/beamforming scheme for higher frequencies in NR.*
- *Proposal 2: For beamformed access, introduce beam sweeping for providing basic coverage in NR.*
  - *Strive for minimizing the overhead related to the beam sweeping.*
- *Proposal 3: Study beam-sweeping based designs for initial access in NR: at least for synchronization signals, broadcast channel and random access channel.*
- *Proposal 4: Study beam-sweeping based designs for RRM measurements in NR.*

Decision: The document is noted.

R1-164372 Coverage Issues of Massive MIMO in NR Huawei, HiSilicon

Observation 1: Additional gain is needed for NR to achieve similar coverage as LTE.
Observation 2: Beam based scheme outperforms repetition based scheme in terms of coverage performance.
Proposal 1: Investigate SFN as a complementary solution for coverage improvement in NR.
Proposal 2: Investigate power boosting solution to improve the coverage of NR.
Proposal 3: Investigate beam based access to improve the coverage of NR.
Proposal 4: The following principles need to be considered for the enhancements on coverage limited signals (such as synchronization and broadcast signals):

- *The signal design should take into account the performance, overhead , complexity and reliability.*
  - *Impacts from phase noise should be considered in system design for HF bands.*
- *The signal design should consider the adopted numerology and multiple access schemes.*

Decision: The document is noted.

R1-164925 Considerations of digital beam forming on multi antenna scheme MTI

- Observation#1: Clearly, DBF has the high performance, and give best operational flexibility with slightly higher cost. The DBF is put the complexity at the cell side, and minimize the complexity and power constraints at UE.
- Observation#2: The cost of DBF is mainly coming from parallel channels of IFP that convert signals from digital domain to IF domain. The IFP may be expensive when design with discrete components, but would be substantially lower cost when implemented with digital IC and RFIC, and when produced at high quantity.
- Proposal 1: Digital beamforming which adopts digital precoding to adjust the beam direction and operating sub band should be considered as well for NR.
- Proposal 2: RAN1 should discuss the design aspects and architecture for DBF, especially considering the maximization of orthogonality and relative blind decoding.

Decision: The document is noted.

R1-165179 Discussion on NR MIMO NTT DOCOMO, INC.

Proposal 1: Following requirements should be considered for NR MIMO design.

- *Feasible overhead for DL/UL RSs and feedback*
- *Versatile technology for different*
  - *Antenna configurations (e.g., number/arrangement of antenna elements and virtualization)*
  - *Frequency bands (e.g., low frequency to mmWave*
  - *Duplex schemes, e.g., FDD/TDD/eTDD*

Proposal 2: Beamforming, SU-MIMO and MU-MIMO should be studied for higher frequency NR together with optimization for massive array and reciprocal systems.
Proposal 3: Following issues should be studied for higher frequency.

- *Impact of blockage effect and possible solutions*
- *Effect of multi-cell association technology*
- *Interference measurement schemes (e.g., flush-light effect and measurement for reciprocal systems)*

Proposal 4: For higher frequency, effect of beamforming on common channels/signals should be studied together with other potential technologies such as repetition, power boosting and SFN transmission.
Proposal 5: Multi-antenna technologies for NR should be applicable for hybrid beamforming (or analogue beamforming).
Proposal 6: For frequencies below 6 GHz, beamforming can be applied both for common and data-plane channels/signals, although details should be discussed together with the design for over 6 GHz.

Decision: The document is noted.

R1-164191 UL MIMO for new radio interface Intel Corporation

- Proposal 1:
  - For below 6GHz band, consider both digital and hybrid antennas at eNB and omni-directional antenna at UE in the NR design.
  - For above 6GHz band, consider multiple hybrid antennas at eNB and multiple hybrid antennas at UE, e.g. two and facing opposite direction, in the NR design.

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- Proposal 2:
  - For below 6GHz band, both sub-array and fully connected virtualization for TRP can be supported by using LTE FD-MIMO framework.
  - For above 6GHz band, prioritize the 2D sub-array based virtualization for eNB/UE in the NR design.
  - It is worth to clarify whether TXRU can be connected to different antenna arrays dynamically at UE.
- Proposal 3:
  - eNB/UE vendors to state intra-array antenna calibration and inter-array antenna calibration assumption for the NR design.
  - NR system design should be flexible enough for different antenna calibration assumptions.
- Proposal 4:
  - Design UL NR MIMO assuming the listed scenarios in Figure 1. UL NR MIMO should support stand-alone operation for all possible bands, however, optimization of the capacity booster layer at middle/high band assuming a coverage layer using LTE or NR at low band can also be considered.
  - Proposal 5:
  - Strive to have a unified uplink NR MIMO framework for all NR bands.
  - Have a relatively independent uplink beam management procedure to downlink
  - Have a beam management framework which can address various scenarios including inter-TRP and intra-TRP beam mobility scenarios.
  - Design uplink physical channels considering the hybrid antennas at both sides of the link.
  - Apply relevant NR MIMO scenarios for various uplink physical channels/signals.
  - Study uplink power control scheme in a beam centric environment.
  - NR at low band should target the same SU-MIMO dimension and higher MU-MIMO dimension than LTE. SRS and DMRS should be designed to be compatible with other system design aspects and better support reciprocity based operation.

Decision: The document is noted.

R1-164892 **General Views on Reference Signal Design** **CMCC**

- Proposal 1: At least NR_SS, NR_CSI-RS and NR_DMRS should be considered for downlink reference signals of NR.
- Proposal 2: A two-stage CSI feedback and corresponding CSI-RS design could be considered in NR
- Proposal 3: NR_SRS and NR_DMRS, whose functionalities are analogous to SRS and DMRS in LTE, could be considered for uplink reference signals of NR.
- Proposal 4: The design of NR_SRS should try to improve its capacity to ensure the accuracy of channel reciprocity in TDD system.

Decision: The document is noted.

R1-164116 **Consideration on muti-antenna schemes for new radio** **Beijing Xinwei Telecom Techn.**

- *Observation 1: Reduction of broadcast signal is also beneficial from perspective of large scale MIMO.*
- *Observation 2: Channel reciprocity in TDD should be carefully invoked, considering the problem of RS contamination and fewer digital chains than antenna elements.*
- *Proposal 1: A universal MIMO framework should be established in the study item for the compatibility of the two-phase standardization process.*
  - *The universal framework should accommodate requirements for different scenarios, including over-6GHz and sub-6GHz deployment.*
- *Proposal 2: Antenna modelling within the NR MIMO framework should not limit the possibility of applying other types of antennas besides URPA.*
- *Proposal 3: The possibility of multiple TXRUs fully connected to the same subarray should not be precluded.*
- *Proposal 4: Novel access and data transmission procedure should be designed with as few broadcast signal as possible and facilitate the usage of spatial information.*
- *Proposal 5: Spatial sparsity of channels could be leveraged to reduce RS overhead.*
- *Proposal 6: RS for spatial information is also beneficial in TDD system.*
- *Proposal 7: Feedback based on RS measurement should be considered as the baseline for NR. Other form of feedback should compared with the baseline on overhead, complexity and performance.*
- *Proposal 8: For antenna array besides URPA, measurement and feedback framework based on beamformed reference signal should be studied.*
- *Proposal 9: Distributed large scale MIMO should be natively supported and facilitated in the NR MIMO framework.*
- *Proposal 10: For distributed large scale MIMO, distributed MRT based scheme should be considered as the baseline for further study.*

Decision: The document is noted.

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R1-164117 **Overview of Massive MIMO for NR National Instruments Corp.**

- Observation 1: Massive MIMO beamforms to a point, conventional beamforming beamforms to a direction.
- Observation 2: Reciprocity based TDD NR MIMO is a scalable solution from CSI estimation overhead perspective, for all antenna sizes.
- Observation 3: Canonical Massive MIMO can work with many flexible antenna configuration and has relaxed antenna calibration requirements.
- Observation 4: The subframe duration of a TDD NR M-MIMO subframe should no longer than the channel coherence time for the given deployment scenario.
- Observation 5: Benefits of Massive MIMO are only apparent with 8-10x the number of transceiver chains at eNB as number of UEs in the cell where each transceiver chain is a digital beamforming element.
- Observation 6: Reciprocity Calibration is necessary. Level of calibration and optional support of over the air signaling for calibration is FFS.
- Observation 7: Reciprocity calibration can be performed within the eNB, with no necessity of signaling between eNB and UE.
- Proposal 1: Use Massive MIMO using channel reciprocity as a framework for TDD NR M-MIMO.
- Proposal 2: Adopt TDD NR M-MIMO as primary MIMO mode for larger number of antenna ports at eNB (especially for >= 64 antenna ports).
- Proposal 3: Study improvements in UL Sounding Pilot signaling to support at least 32 UEs in UL.
- Proposal 4: Support a flexible grant duration for TDD NR M-MIMO subframe to be smaller than the channel coherence time.
- Proposal 5: Support fully digital beamforming for up to at least 64 antenna ports at the eNB.

Decision: The document is noted.

R1-165313 **Need for study on In-Band Full Duplex communication CEWiT**

Proposal 1: To consider in-band full duplex communication in conjunction with massive MIMO systems.

Proposal 2: To consider and study other potential network wide applications and standardization impact of in-band full duplex communication.

Decision: The document is noted.

R1-164955 **Reciprocity based MIMO in NR Ericsson**

- Efficient reciprocity-based transmission schemes need to be standardized as in some use cases they will have significantly better performance compared to normal resolution closed loop schemes (as has been specified for smaller arrays, e.g. LTE)
- Coherent reciprocity allows for efficient acquisition of explicit channel knowledge even for very large arrays, thus enabling frequency-selective precoding and nullforming
- Achieving coherent reciprocity imposes several additional requirements, e.g., on antenna calibration
  - Whether there is standard impact (RAN1 or RAN4) is FFS
- Study proposals to support reciprocity based MIMO in NR:
  - RAN1 should study Sounding Reference Signal design and the necessary quality of the estimates
    - Study SRS sequences and SRS density for enabling high-quality channel estimates, to reduce the effects of channel aging and pilot contamination
  - RAN1 should study Interference acquisition schemes for reciprocity based operation
    - for the purpose of scheduling and link adaptation

Decision: The document is noted.

R1-165559 **WF on Supported NR OperationsSamsung, Nokia, Alcatel Lucent Shanghai Bell**

The document was presented by Young Han Nam from Samsung.

- RAN1 to strive for both beam-centric operation and non-beam-centric operation in a single unified framework
  - Beam-centric operation
    - In beam-centric operation, multiple beams are used for covering a DL/UL coverage area of a TRP/a UE.
    - One example of beam-centric operation is beam sweeping:
      - When beam sweeping is applied for a signal (or a channel), the signal (the channel) is transmitted on multiple beams, which are on multiple time instances in a constant time duration.
  - Non-beam-centric operation
    - In non-beam-centric operation, a single beam can be used for covering a DL/UL coverage area of a TRP/a UE, similarly as for LTE cell-specific channels/RS.
- For beam-centric operation, study the application of beam sweeping at least for:
  - Initial-access signals (synchronization signals and random access channels)
  - System-information delivery (broadcast channels)
  - RRM measurement

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– CSI measurement

Decision: The document is noted.

Possible agreements:

- Following three types of beamforming are to be studied in NR
  - Analog beamforming
  - Digital beamforming
  - Hybrid beamforming
- RAN1 studies both beamforming based approaches and non-beamforming based approaches for these channels/signals/measurement/feedback
  - Initial-access signals (synchronization signals and random access channels)
  - System-information delivery (broadcast channels)
  - RRM measurement/feedback
  - L1 control channel
  - FFS: Note: The physical layer procedure design for NR should be agnostic as much as possible to the beamforming type employed at TRP
- Beamforming based approaches
  - In beamforming based approaches, multiple beams are used for covering a DL coverage area and/or UL coverage distance of a TRP/a UE
  - One example of beamforming based approaches is beam sweeping:
    - When beam sweeping is applied for a signal (or a channel), the signal (the channel) is transmitted/received on multiple beams, which are on multiple time instances in finite time duration
      - Multiple beams can be transmitted/received in a single time instance
  - Others are FFS
- Non-beamforming based approaches
  - In non-beamforming based approaches, each time invariant beam can be used for covering a DL/UL coverage area of a TRP/a UE, similarly as for LTE cell-specific channels/RS
- For both beamforming and non-beamforming based approaches, RAN1 can consider following examples
  - Power boosting
  - SFN
  - Repetition
  - Beam diversity (only for beamforming approach)
  - Antenna diversity
  - Other approaches are not precluded
- Combinations of non-beamforming based and beamforming based approaches are not precluded

Agreements:

- Following three implementations of beamforming are to be studied in NR
  - Analog beamforming
  - Digital beamforming
  - Hybrid beamforming
  - Note: The physical layer procedure design for NR can be agnostic to UE/TRP with respect to the beamforming implementations employed at TRP/UE, but it may pursue beamforming implementation specific optimization not to lose efficiency
- RAN1 studies both multi-beam based approaches and single-beam based approaches for these channels/signals/measurement/feedback
  - Initial-access signals (synchronization signals and random access channels)
  - System-information delivery
  - RRM measurement/feedback
  - L1 control channel
  - Others are FFS
  - Note: The physical layer procedure design for NR can be unified as much as possible whether multi-beam or single-beam based approaches are employed at TRP at least for synchronization signal detection in stand-alone initial access procedure
  - Note: single beam approach can be a special case of multi beam approach
  - Note: Individual optimization of single beam approach and multiple beam approach is possible
- Multi-beam based approaches
  - In Multi-beam based approaches, multiple beams are used for covering a DL coverage area and/or UL coverage distance of a TRP/a UE
  - One example of multi-beam based approaches is beam sweeping:
    - When beam sweeping is applied for a signal (or a channel), the signal (the channel) is transmitted/received on multiple beams, which are on multiple time instances in finite time duration

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- Single/multiple beam can be transmitted/received in a single time instance
  - Others are FFS
- Single-beam based approaches
  - In single-beam based approaches, the single beam can be used for covering a DL coverage area and/or UL coverage distance of a TRP/a UE, similarly as for LTE cell-specific channels/RS
- For both single-beam and multi-beam based approaches, RAN1 can consider followings in addition
  - Power boosting
  - SFN
  - Repetition
  - Beam diversity (only for multi-beam approach)
  - Antenna diversity
  - Other approaches are not precluded
- Combinations of single-beam based and multi-beam based approaches are not precluded

R1-165563 **WF on NR beamforming Huawei, HiSilicon**

The document was presented by … from Huawei.

- Following three types of beamforming are to be studied in NR
  - Analog beamforming
  - Digital beamforming
  - Hybrid beamforming
- Study coverage improvement techniques for control channels / signals for NR
  - Beamforming-based coverage improvement
    - Beam sweeping and beam selection techniques
  - Non-beamforming based approaches such as
    - Power boosting
    - SFN
    - Repetition
  - Combinations of non-beamforming based and beamforming based approaches are not precluded
  - Other methods are not precluded

Note: The physical layer procedure design for NR should be agnostic as much as possible to the beamforming type employed at TRP.

Decision: The document is noted.

Possible agreements:

- For Non-beam-centric operation, RAN1 can consider following examples
  - Power boosting
  - SFN
  - Repetition
  - Combinations of non-beamforming based and beamforming based approaches are not precluded

Note: The physical layer procedure design for NR should be agnostic as much as possible to the beamforming type employed at TRP.

Tuesday

R1-165564 **WF on UE beamforming and beam management Nokia, Samsung, Intel, Interdigital, Alcatel-Lucent Shanghai Bell**

Decision: The document is noted.

Agreements:

- RAN1 to study the beamforming procedures and their system impacts at least for multi beam based approach
  - Physical layer procedures for beamforming optimizing different metrics such as overheads and latencies in multi beam and single beam based approaches
  - Physical layer procedures in multi beam based approach that require beam training, i.e. steering of transmitter and/or receiver beams
    - E.g. Periodic/Aperiodic downlink/uplink TX/RX beam sweeping signals, where periodic signals may be semi-statically or dynamically configured (FFS)
    - E.g. UL sounding signals
    - Other example is not precluded

R1-165684 **WF on beamforming procedures Nokia**

Decision: The document is noted.

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Agreements:

- Both intra-TRP and inter-TRP beamforming procedures are considered.
- Beamforming procedures are considered with/without TRP beamforming/beam sweeping and with/without UE beamforming/beam sweeping, according to the following potential use cases:
  - UE movement, UE rotation, beam blocking:
    - Change of beam at TRP, same beam at UE
    - Same beam at TRP, change of beam at UE
    - Change of beam at TRP, change of beam at UE
  - Other cases are not precluded

R1-165650 WF on the antenna port and QCL assumption study in NR Intel, Ericsson
Decision: The document is noted.
Possible agreements:
As a starting point for NR study RAN1 assumes the following definition of antenna port and corresponding antenna port transmission assumptions:

- The antenna port in NR is used for transmission of a physical channel or signal, where an antenna port is defined such that the channel over which a symbol on the antenna port is conveyed can be inferred from the channel over which another symbol on the same antenna port is conveyed.
- For antenna port transmitted in different time occasions (e.g. different subframes or TTIs) by default assumption the channel on the antenna port in one time occasion can't inferred from the channel on the same antenna port in another time occasion
- For antenna port transmitted in the same time occasion on different frequency resource units (blocks), by default assumption the channel in one frequency resource unit/block on one antenna port can't inferred from the channel on the same antenna port in another frequency resource unit/block in the same time occasion

The assumptions on antenna ports that are different from the above should be studied in RAN1 and if needed recommended for NR specification (e.g. fixed in the specification or signaled by network explicitly or implicitly)
Possible agreements:
As a starting point for NR study RAN1 assumes the following definition of QCL and corresponding QCL assumptions:

- Two antenna ports in NR are said to be quasi co-located if the large-scale properties of the channel over which a symbol on one antenna port is conveyed can be inferred from the channel over which a symbol on the other antenna port is conveyed. The large-scale properties include one or more of delay spread, Doppler spread, Doppler shift, average gain, and average delay.
- For antenna ports corresponding to different RS types (e.g. DM-RS and CSI-RS) or multiple RS of the same type (e.g. two NZP CSI-RS) by default assumption UE can't assume QCL-ion between the antenna ports wrt to delay spread, Doppler spread, Doppler shift, average gain, and average delay.
- For antenna ports corresponding to the same type (e.g. DM-RS antenna ports), by default assumption UE can't assume QCL-ion between antenna ports wrt to delay spread, Doppler spread, Doppler shift, average gain, and average delay.

The assumptions on QCL that are different from the above should be studied in RAN1 and if needed recommended for NR specification (e.g. fixed in the specification or signaled by network explicitly or implicitly)
Continue offline discussion – (Intel)
Thursday
R1-165905 **WF on the antenna port and QCL assumption study in NR** **Intel, Ericsson**
Decision: The document is noted. Revised in:
R1-165947 **WF on the antenna port and QCL assumption study in NR** **Intel, Ericsson, ZTE, LGE, Samsung, Nokia, ASB, CATT**
Decision: The document is noted.

Agreement: Study the necessity of QCL and measurement assumptions for antenna ports in NR

R1-165588 **WF on hybrid UE antenna modelling** **Intel, Samsung**
Decision: The document is noted. Revised in:
R1-165712 **WF on hybrid UE antenna modelling** **Intel, Samsung**
Decision: The document is noted.

R1-165654 **WF on CSI Acquisition Framework in NR** **Huawei, HiSilicon, NTT DOCOMO, Intel, China Telecom, ZTE, China Unicom, Deutsche Telecom, Softbank, ETRI, Ericsson, Nokia**
Decision: The document is noted. Also supported by CATR, ASB.

Agreements:

- In NR multi-antenna schemes, studies on CSI acquisition framework include:

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- CSI reporting schemes
  - Implicit CSI feedback
    - Parameters indicating channel quality based on a set of transmission and receiving hypotheses associated with one particular UE, e.g. CQI, PMI, RI, CRI
  - Explicit CSI feedback: for both quantized and unquantized/analog CSI feedback
    - Parameters representing channel coefficients or some reduced-space representation thereof
  - Reciprocity-based feedback
    - For example, take into account interference and/or receiver hypothesis can be included
  - Note: including aperiodic, periodic and semi-persistent, and single/wide band and sub-band feedback
  - Mixed feedback is not precluded
- Interference measurement
- FFS: CSI measurement and/or reporting and/or triggering can be 'self-contained' in at least time domain

Possible agreements:

- In NR multi-antenna schemes, studies on CSI acquisition framework include
  - CSI acquisition
    - based on hybrid RS
      - E.g., hybrid non-precoded and beamformed RS
      - E.g., hybrid different types of beamformed RS
    - based on beamformed/precoded RS (e.g., CSI-RS, Demodulation RS)
    - based on non-precoded RS
    - based on reciprocity (e.g., SRS design, UL SRS Transmission in DL band)
    - Note: including measurement over aperiodic/periodic/semi-persistent RS
    - Note: Subband RS is not precluded

Continue offline discussion until Wednesday – (Huawei)

R1-165541 **WF on CSI reporting framework for NR Samsung, Interdigital, Ericsson**
Decision: The document is noted.
R1-165701 **WF on RS design for CSI measurements in NR Samsung, ZTE, ZTE Microelectronics, Intel, Ericsson**
Decision: The document is noted. Continue offline discussion until Wednesday – (Samsung)

Wednesday

R1-165843 **WF on CSI Acquisition in NR Huawei, HiSilicon, Samsung**

- In NR multi-antenna schemes, studies on CSI acquisition include;
  - based on RS for UE-specific use case
    - Note: mutiple-stage RS is not precluded
    - e.g., beamformed CSI-RS, Demodulation RS
  - based on RS for non-UE-specific use case
    - Note: mutiple-stage RS is not precluded
    - e.g., beamformed CSI-RS, Non-precoded CSI-RS
  - based on hybrid RS
    - E.g., hybrid RS for UE-specific and Non-UE-specific use cases
  - based on reciprocity (e.g., SRS design, UL SRS Transmission in DL band)
  - Note: including measurement over aperiodic/periodic/semi-persistent RS
  - Note: Subband RS is not precluded

Decision: The document is noted, modified as follows:

Agreements:

- In NR multi-antenna schemes, studies on RS design and CSI acquisition considering following use cases
  - Non-UE-specific RS use case for CSI measurement
  - UE-specific RS use case for CSI measurement
    - Note: functionally may be analogous e.g.: to R13/14 UE-specific beamformed CSI-RS (with dynamic beamforming)
    - Note: maybe relevant to UE receiving beam sweeping
  - Use of a joint operation among multiple RS from the same or different use cases
  - RS for interference measurement use cases
  - RS for channel reciprocity use cases
  - Other use cases is not precluded
- Note: including measurement over aperiodic/periodic/semi-persistent RS
- Note: Subband RS is not precluded

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R1-165590 **WF on aperiodic CSI for NR ZTE, ZTE Microelectronics, ASTRI, Ericsson, Samsung**

- Study aperiodic CSI reporting in conjunction with aperiodic RS (including multi-shot RS) transmission
  - UE measures/reports CSI and TRP transmits RS for CSI measurement only when needed
  - Study self-contained scheme to support CSI triggering, CSI measurement and CSI feedback in a subframe
  - Study RS design for CSI measurement e.g. CSI-RS, demodulation RS.
    - Others are not precluded

Decision: The document is noted. Also supported by Interdigital. The WF is updated as follows:

Agreements:

- Study aperiodic CSI reporting in conjunction possibly with aperiodic RS (e.g. one-shot, multi-shot RS) transmission
  - Aperiodic RS can be used for CSI measurement including channel measurement (e.g. using CSI-RS) and/or interference measurement (e.g. using IMR)
  - Study on demand UE measurement/reports and TRP RS transmission for CSI measurement only when needed
  - Study aperiodic CSI procedure to support CSI triggering, CSI measurement and CSI feedback in certain time interval(s). These three steps can happen in the same or different time interval.
  - Study aperiodic CSI procedure using RS for CSI measurement e.g. CSI-RS, demodulation RS.
    - Others are not precluded

R1-165808 **WF on NR UL MIMO Intel, NTT DOCOMO, Ericsson**

Decision: The document is noted.

Agreements:

- The following techniques are studied for NR UL MIMO
  - Uplink transmission/reception schemes for data channels
    - Non reciprocity based UL MIMO (e.g. PMI based)
    - Reciprocity based UL MIMO. E.g. UE derives precoder based on downlink RS measurement (including partial reciprocity)
    - Support of MU-MIMO
    - Open-loop/Close-loop single/Multi point spatial multiplexing
      - e.g. for multi point SM, multi layer is received either jointly or independently by different TRPs
      - Note: for multi point SM, multiple point may have coordination
    - Single/Multi panel spatial diversity
    - Uplink antenna/panel switching (UE side)
    - UL beamforming management for analog implementation
    - Combination of above techniques
  - UL RS design considering the below functions
    - Sounding
    - Demodulation
    - Phase noise compensation
  - UL transmit power/timing advance control in the context of UL MIMO
  - Transmission scheme(s) for carrying UL control information
  - Other UL MIMO and related techniques are not precluded

Possible agreements:

- Study beam determination procedure (e.g. TRP beam(s) and/or UE beam(s) determination)
  - Option 1: In the initial access procedure
  - Option 2: Not in the initial access procedure
- For beam change after initial beam determination, study the following two procedures:
  - Procedures different from initial beam determination procedure
    - E.g. L1 or L2 based approach
  - Procedures with the same procedure as initial beam procedure
- Note: A common procedure may be applied to initial beam determination and beam change.
- Note: Different procedures may be applied to different frequency resources
- For multi beam and single beam based approaches at TRP, companies should state the assumptions on UE beamforming for the agreed system aspects
  - E.g. how many UE beams and UE beam patterns

Continue offline discussion until Friday – Yuan (Intel)

R1-166030 WF on beam management Intel, Ericsson, Nokia, Qualcomm, Samsung, ZTE, NTT DoCoMo, Huawei, Xinwei, CATT, MTK

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R1-165946 **WF on DL multi-antenna transmissions for NR** **LG Electronics, CATT, Intel, Samsung**
Decision: The document is noted, modified and agreed as follows:

Agreements:

- The following DL multi-antenna transmissions to be studied for NR
  - Closed-loop/(Semi)Open-loop spatial multiplexing
  - Single/Multi-point transmissions
  - SU/MU-MIMO
  - Transmit diversity,
    - e.g., Single/Multi panel spatial diversity
  - Combination of above techniques
- Other DL multi-antenna transmissions and related techniques are not precluded
- This does not imply that used transmission technique needs to be known to the UE

R1-165929 **WF on beamforming for message transmission in NR** **Qualcomm, Ericsson, Intel, Nokia, CATT, Samsung**
Decision: The document is noted.

Possible agreements:

- RAN1 to study beamforming for transmitting control message in the multi-beam based approach for NR
  - Beamforming that is specific to a UE or group of UEs when transmitting control message (i.e. control transmission)
    - Procedures for determining (e.g., through beam training) and changing the beam used for the control transmission
      - Procedures may or may not be same as the procedure for determining/changing the beam for data transmission
    - Control transmissions may be in both UL or DL direction
  - Procedures when transmitting common control message (e.g. beam sweeping, wide beam)

Continue offline discussion until Friday – Sundar (Qualcomm)

The document was presented by … from … and
Discussion: .
Decision: The document is noted.

Not treated.

R1-164010	Discussions on CSI-RS design for NR	Samsung
R1-164011	Discussions on CSI reporting for NR	Samsung
R1-164012	Discussion on advanced MIMO transceivers for NR	Samsung
R1-164014	Discussion on RS for beamformed access	Samsung
R1-164016	UL MIMO framework for NR	Samsung
R1-164017	Advanced CSI feedback for NR	Samsung
R1-164018	Analog/digital/hybrid beamforming for massive MIMO	Samsung
R1-164019	Discussion on CSI acquisition for beamformed access	Samsung
R1-164027	Design of massive MIMO for New Radio	Mitsubishi Electric Co.
R1-164038	Motivations and Considerations on Massive MIMO for New RAT	Huawei, HiSilicon
R1-164118	Frame Structure and Signaling for Reciprocity Calibration in Massive MIMO	National Instruments Corp.
R1-164188	Overview of multi-antenna schemes for new radio interface	Intel Corporation
R1-164189	On UE side beamforming	Intel Corporation
R1-164190	RSRP modeling with UE side beamforming	Intel Corporation
R1-164254	Views on NR MIMO design	CATT
R1-164255	Discussion on beam-based operation	CATT
R1-164256	NR MIMO based on channel reciprocity	CATT
R1-164294	Overview on NR MIMO for sub-6 GHz	ZTE
R1-164295	Overview on NR MIMO for above-6 GHz	ZTE
R1-164296	Discussion on beamforming architecture for NR MIMO	ZTE
R1-164297	Consideration on CSI measurement and feedback for NR MIMO	ZTE
R1-164334	Discussion on massive MIMO in NR	Fujitsu
R1-164349	Discussion the transmission scheme of M-MIMO for 5G system	Fiberhome Technologies Group
R1-164374	CSI Acquisition Framework for Massive MIMO in New Radio	Huawei, HiSilicon
R1-164485	Discussion on Multi-antenna scheme for NR	NEC
R1-164567	Massive MIMO for New Radio Interface	LG Electronics
R1-164624	Principles for downlink control signaling in NR	Ericsson

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R1-164625 Design principles for system access in a beam-centric system Ericsson
R1-164660 Enhanced multiple antenna transmission for NR Sony
R1-164707 Massive MIMO architecture Qualcomm Incorporated
R1-164708 NR Massive MIMO design considerations Qualcomm Incorporated
R1-164872 Initial views on MIMO/Beamforming in the NR systems ETRI
R1-164873 Use of polarized MIMO for NR ETRI
R1-164874 Beam-based design framework for New Radio INTERDIGITAL COMMUNICATIONS
R1-164891 On Gradual UE-specific (GUS) Beamformed Control Channel CMCC
R1-164893 Hybrid Beamforming for Massive MIMO CMCC
R1-164952 On CSI for multi-antenna operation in NR Ericsson
R1-164953 Multi-antenna transmission principles for data channels in NR Ericsson
R1-164954 SU-MIMO performance for antenna arrays with a massive number of antennas Ericsson
R1-164956 Multi-point MIMO connectivity Ericsson
R1-164957 On UE side beamforming in NR Ericsson
R1-165037 Discussion on Design of Reference Signals for NR MIMO ZTE
R1-165038 Discussion on Control Channel Design for NR MIMO ZTE
R1-165062 Views on Beamforming with a Large Number of Antennas INTERDIGITAL COMMUNICATIONS
R1-165063 Views on Massive MIMO for New Radio INTERDIGITAL COMMUNICATIONS
R1-165079 Consideration on advanced receivers for NR Intel Corporation
R1-165166 Support of Multiuser Transmission in 5G New Radio Interface below 6GHz MediaTek Inc.
R1-165167 Beamforming Considerations for above 6 GHz Deployment Scenarios MediaTek Inc.
R1-165180 Discussion on Multi-Antenna Transmission of Synchronization and Reference Signals NTT DOCOMO, INC.
R1-165363 Scalability of MIMO operation across NR carrier frequencies Nokia, Alcatel-Lucent Shanghai Bell
R1-165364 Support for Beam Based Common Control Plane Nokia, Alcatel-Lucent Shanghai Bell
R1-165365 On the UE beamforming in new radio Nokia, Alcatel-Lucent Shanghai Bell
R1-165366 Channel reciprocity support in NR Nokia, Alcatel-Lucent Shanghai Bell

7.1.7 Others

R1-164020 Co-existence of LTE and NR Samsung

- *Proposal 1: LTE-NR coexistence on the same spectrum should be supported as part of NR.*
- *Proposal 2: Consider both geographically separated and co-located scenarios when designing NR specification support for LTE-NR coexistence.*
- *Proposal 3: Design TDD UL-DL configurations for NR such that at least a subset of the configurations are compatible with those of LTE.*
- *Proposal 4: Consider utilizing LTE features to efficiently support LTE-NR coexistence for co-located scenario.*

Discussion: Huawei→ time domain coexistence issues are relevant to this SI.
Decision: The document is noted.

R1-164021 Network topology and system operation for NR Samsung
R1-164022 Discussion on interference coordination for NR Samsung
R1-164023 Discussion on interference management based on advanced transceivers for NR Samsung
R1-164024 Shared spectrum support for NR Samsung
R1-164042 Wideband support for NR Huawei, HiSilicon
R1-164043 Considerations on vehicular communications for NR Huawei, HiSilicon
R1-164053 Support for flexible backhauling for NR Huawei, HiSilicon
R1-164054 Support for energy efficient NR Huawei, HiSilicon
R1-164371 Considerations on new radio access mechanisms in NR Huawei, HiSilicon
R1-164379 Support for UE Cooperation in NR Huawei, HiSilicon
R1-164382 Advanced Link Adaptation for NR Huawei, HiSilicon
R1-164568 High level view on eV2X LG Electronics
R1-164709 Sidelink design for NR Qualcomm Incorporated
R1-164710 Mobility considerations for NR Qualcomm Incorporated
R1-164714 NR positioning Qualcomm Incorporated
R1-165064 Design considerations on URLLC for New Radio systems INTERDIGITAL COMMUNICATIONS
R1-165182 Discussion on affinity for unlicensed spectrum access in 5G new radio NTT DOCOMO, INC.
R1-165373 On Hybrid ARQ functionality for 5G Nokia, Alcatel-Lucent Shanghai Bell
R1-165374 On the utilization of UE Advanced Receivers in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-165375 On the cross-link interference mitigation Nokia, Alcatel-Lucent Shanghai Bell
R1-165376 Radio resource management in NR Nokia, Alcatel-Lucent Shanghai Bell
R1-165377 Random access principles for New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-165378 On network energy efficiency requirement and evaluation for the 5G new radio Nokia, Alcatel-Lucent Shanghai Bell

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R1-165379 Network-based inter-cell interference coordination Nokia, Alcatel-Lucent Shanghai Bell
R1-165380 Uplink power control for 5G New Radio Nokia, Alcatel-Lucent Shanghai Bell
R1-165381 Punctured Scheduling for Latency Critical Transmissions Nokia, Alcatel-Lucent Shanghai Bell
The document was presented by … from … and
Discussion: .
Decision: The document is noted.

7.2 Study on channel model for frequency spectrum above 6 GHz - SID in RP-151606

R1-164025 Chairman's Notes of Agenda Item 7.2 on Channel model for >6 GHz Nokia
The document was presented by Tuomo Säynäjäkangas from Nokia and provides the outcomes of AI7.2.
Decision: The document isendorsed. Contents incorporated below.

Remaining issues

R1-164606 List of open issues for channel modelling SI Nokia, Samsung
Discussion:
Decision: The document is noted

R1-165372 Notation of log-normal distributed random variables Fraunhofer HHI
Proposal 1: Adopt the following notation for mean ($\mu_{\lg X} = \mathrm{mean}\{\log_{10}(X)\}$) and standard deviation ($\sigma_{\lg X} = \mathrm{std}\{\log_{10}(X)\}$) of logarithmized parameters.
Proposal 2: When presenting mean values of logarithmized parameters in linear scale, clarify whether $10^{\mu_{\lg X}}$ or μ_X is given.
Discussion:
Samsung: Has this been used in previous channel model work or is this a new one?
Fraunhofer: This is an old problem. We should avoid misunderstanding.
Samsung: We could agree in principle and think about the wording for a TR.
Decision: The document is agreed

TR update

R1-164607 TP for TR38.900 on Section 7.2 Nokia, Samsung
Discussion:
Ericsson: 38.953 mention indoor car users to be reflected too.
Fraunhofer: Then we need to add more details on that model. 7.2.1 table to be corrected.
Huawei: Table 7.2.2 values are already agreed.
We should agree this TP first. It captures agreement from last meeting. Modifications can be added for the next version.
Decision: The document is agreed

R1-164608 TP for TR38.900 on Section 7.4 Nokia, Samsung
Discussion:
Nokia: More clarifications are needed for O2I section in this meeting.
Fraunhofer: We need to decide parameter d. PL equations are modified. It is not clear what frequencies are meant. General note of units and equations needs clarifications.
NTT DOCOMO: Rural macro scenario frequency range is not clear.
Nokia: It is up to 7 GHz.
Decision: The document is agreed

R1-164609 TP for TR38.900 on Section 7.5 Nokia, Samsung
Discussion:
LGE: Steps 2 and 3 should be corrected.
Fraunhofer: Some parameters needs further clarifications.
NTT DOCOMO: Table 7.5 unit of distance needs further clarifications.
Decision: The document is agreed

R1-164610 TP for TR38.900 on Section 7.6 Nokia, Samsung
Discussion:
Motorola: Equation and impulse response corrections are needed. Why impulse response is a function of f?
Decision: The document is agreed

R1-164611 TP for TR38.900 on Section 7.7 Nokia, Samsung

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Discussion:
Huawei: There are couple of issues to be corrected.
Samsung: There are some errors not captured but discussed in email discussions.
Ericsson: We agreed also K-factor scaling for LOS.
Decision: The document is agreed

R1-164612 **TP for TR38.900 on Section 7.8 Nokia, Samsung**
Discussion:
Decision: The document is agreed

R1-164613 **TP for TR38.900 on Section 8 Nokia, Samsung**
Discussion:
Decision: The document is agreed

R1-164614 **WF on TR clean up Nokia, Samsung, AT&T, Ericsson, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm**

- *Proposal-1: For all the parameter values in bracket, remove the brackets (confirm the value in bracket) if no proposals of other value are received in RAN1#85.*
- *Proposal-2: Address all FFS points in the TR in RAN1#85.*
- *Proposal-3: Section 7.2, every scenario has a sentence like: "Other parameters are FFS". Remove the FFS sentences for each scenario with the understanding of "other parameters can be considered"*

Discussion:
Fraunhofer: "Other parameter can be considered" has a different meaning. Missing parameters are FFS.
Nokia: Intention is not to replace the sentence but to remove "*Other parameters are FFS".*
ZTE: We are OK with intention but safer way would be to mention numbers can be revised if problems are found.
Nokia: Every parameters can be revised if issues are found.
Decision: The document is agreed

R1-164615 **Detailed parameters for RMa scenario description Nokia, Samsung, AT&T, Ericsson, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm**
Use below table in section 7.2 for RMa scenario description
Discussion:
LGE: Is BS-UT distance 2d or 3d?
Nokia: 2d
Fraunhofer: In car users are mentioned but why are we not considering pedestrians at all?
Nokia: This is in line with NR SI
Huawei: Other scenarios mention also UE mobility. Should that be considered also for RMa?
Nokia: 3D CM mention reasonable UE speed. Our proposal is to remove that from all scenarios.
Fraunhofer: How to do simulations then?
Nokia: That can be done in separate WI like FD-MIMO.
Motorola: Range of speed could be add on assumption.
Ericsson: It is not mandated for simulations but meant for calibration purposes.
Huawei: We need to clarify the speed for the in car users.
Decision: The document is agreed

R1-165465 **TP for TR38.900 Nokia, Samsung**
Discussion:
Decision: The document is agreed

R1-165757 **Applicability of TR38.900 channel models Huawei, HiSilicon**
Discussion:
Samsung: Some of these are already understood. There is no confusion to correct.
Fraunhofer: RMa scenario should be applicable to up to 7 GHz.
Nokia: We should not this document. RMa is a new and special scenario.
LGE: No need to approve.
Huawei: Don't we need to evaluate whether the model fulfil the requirements?
Samsung: Additional features are already specified in TR.
Decision: The document is noted

R1-165758 **Discussion on the channel model names and abbreviations Huawei, HiSilicon**

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Discussion:
Samsung: We don't support HF. E.g. NR could be better.
Ericsson: We support NR
LGE: 5G or NR.
Nokia: NR is OK even it is a technology.
Rapporteur could implement the name change by using some acronym in TR abbreviations. Discuss by Friday lunch time. If no agreement then the current names are used.
Decision: The document is noted.
Friday: Current names are used for >6GHz channel model study (TR38.900)

R1-165478 **Corrections for CIR Equations** **Fraunhofer HHI, Motorola Mobility, Lenovo**
Discussion:
LGE: No strong concerns but clarifications needed for proposals 1 and 2. Why we have to change?
Fraunhofer: To avoid misunderstandings. Sometimes people don't realize if we are in time domain or not.
Samsung: Everybody know these models used in the past so need to change. What is actually proposal 3?
Fraunhofer: Change from + to – sign. Lambda f is not defined anywhere. We want to make clear what is coefficient and what is CIR.
Samsung: Rapporteur can do the editorial changes.
Huawei: This is not only editorial change. Equations are different.
Motorola: Errors has to be corrected.
Decision: The document is revised in 5774

R1-165774 **Corrections for CIR Equations** **Fraunhofer HHI, Motorola Mobility, Lenovo, CATT, Huawei, HiSilicon**
Discussion:
Samsung cannot agree. Equations and been used for long time, also in 3D CM. There is no strong reason to change.
Samsung: As compromise delay correction in Proposal 3 can be agreed in principle
ZTE has concerns on proposal 3. Same should be done also for hybrid model.
Delay correction in Proposal 3 can be agreed
Decision: The document is noted

Friday
R1-165775 **WF for TR clean-up** **Nokia, Samsung, Huawei, Hisilicon, Intel, NTT DOCOMO, Qualcomm, AT&T, KT Corporation, Alcatel-Lucent Shanghai Bell, ZTE, Interdigital**
- Remove all brackets in the TR38.900

Discussion:
Decision: The document is noted as working assumption

Agreement: Use 3D distance in RMa path loss

R1-165768 **TR38.900 v0.4.0** **Samsung, Nokia**
Discussion:
Decision: The document is return.
Friday: The document is agreed in principle, and email approval to check the consistency with the agreements reached in RAN1#84bis and RAN1#85 meetings until June 2nd – (Samsung)

Offline session notes

R1-165457 **Minutes of offline session on Tue** **Nokia**
Discussion:
Decision: The document is noted

R1-165467 **Minutes of offline session on Wed** **Samsung**
Discussion:
Decision: The document is noted

Friday
Email discussions

Email discussion until the next meeting for full calibration – R1-165770

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[85-19] Email discussion until June 10th for updating results for large scale calibration (Samsung)
[85-20] Email discussion until June 25th for full calibration results (Samsung)
[85-21] Email discussion until June 25th for additional feature calibration (Samsung)
[85-22] Email discussion until August 10th for approval of the summary related to all the calibration results and updated TP (Samsung)

7.2.1 Remaining details on large scale modelling for >6GHz

Path loss modeling

R1-164729 WF on Pathloss clean up Huawei, HiSilicon, Nokia, Samsung, AT&T, Ericsson, Intel, KT Corporation, NTT DOCOMO, Qualcomm, ETRI

- *For UMa, UMi Street Canyon, Indoor office and RMa, limit the NLOS pathloss by LOS pathloss. (same as 36.873)*
- *NLOS Pathloss is defined as the Max(PL_LOS, PL_NLOS):*
  where PL_NLOS and PL_LOS are LOS and NLOS PL formula in current TR

Discussion:
ZTE: We are OK but do we need to redo calibration?
Samsung: We don't need to redo calibration as we have good enough match between companies already.
Fraunhofer: What about RMa calibration? It would be important to include also that.
Samsung: That is different scenario discussed in NR session. No need for that calibration.
Nokia: No need to have another calibration campaign but companies can update their results if they want.
ZTE: This propose max for all scenarios.
Decision: The document is agreed

Penetration loss

R1-164569 Remaining issues on large scale modeling LG Electronics

Proposal 1: Whether to use high or low loss model should be UE-specific.
Proposal 2: The 2D indoor distance, d_in, should be common for sectors of an eNB but differently generated for different (non-collocated) eNBs.
Proposal 3: O-to-I penetration loss deviation should be common for 3 sectors of an eNB but different one for different eNB, and it should replace shadow fading of path loss.
Proposal 4: The clarifications on (1) high vs. low loss model, (2) d_in, and (3) O-to-I penetration loss deviation should be included into large scale modeling section of the TR rather than calibration assumption section.

Discussion:
Decision: The document is not treated

R1-164617 Clarifications on O-I implementation Nokia, AT&T, Ericsson, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung

- *Clarify the implementation of O-I in TR38.900 as following:*
  - *The selection of high loss or low loss O-I model is UE specific*
  - *O-I deviation is an add-on term to SF.*
    - *Change the standard deviation to 4.4 and 6.5 for low loss and high loss penetration model separately (see below table from R1-163256)*
    - *O-I deviation is UE specific random variable.*
  - *d_in is an UE specific random variable*

Discussion:
LGE: We have prepared another WF on this issue.
Decision: The document is revised in 5458

R1-165458 Clarifications on O-I implementation Nokia, AT&T, Ericsson, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung
Discussion:
Decision: The document is withdrawn.

R1-165451 WF on O-to-I penetration modeling LG Electronics, CATT, CHTTL, Intel, ITRI
Discussion:
Straight Path: Modeling should be site specific. UE specific is not a good approximation e.g. what comes to correlation. Deviations are depended to angle.
Nokia: Site specific was our original proposal but after discussing with other companies we believe US specific is more close to reality.
Straight Path: There are penetration coming from the 4 side of the UE. Those should be site specific.

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Ericsson: Propagation is typically coming from the closest wall. This increases the correlation. Shadow fading is link specific and should be accounted for also.
Samsung: Can we agree Proposal 1 Option 2 and proposal 2.
LGE prefers option 1.
CATT: We prefer option 1.
Straight Path: We prefer option 1.
Decision: The document is revised in 5464

R1-165464 **WF on O-to-I penetration modeling LG Electronics, Straight Path, Ericsson, Samsung, Nokia, Alcatel-Lucent Shanghai Bell, ETRI, CHTTL, NTT DOCOMO, Huawei, HiSilicon**
Discussion:
Decision: The document is agreed

R1-165463 **WF on O2I Penetration Loss Model Mix for Urban Scenarios Huawei, HiSilicon, CATT**
Discussion:
Decision: The document is agreed

R1-165849 **WF on clarification on O2I penetration modeling for RMa LG Electronics, Ericsson, ETRI, Samsung, Straight Path, NTT DOCOMO, Intel, Nokia, Alcatel-Lucent Shanghai Bell, CHTTL**

- *For RMa scenario, the indoor 2D distance ($d_{2D\text{-}in}$) for indoor UE is generated in the same manner agreed in R1-165464.*
  - *$d_{2D\text{-}in}$ is UE-specific and generated as the minimum of two independent uniform RVs between 0 and 25 m.*
  - *Other channel modeling steps that should utilize $d_{2D\text{-}in}$ follow the same calculation for $d_{2D\text{-}in}$.*
- *The correlation distance for cluster/ray specific random variables for RMa O2I scenario is 15m.*
  - *Note that this value is the same as one for UMa/UMi-Street Canyon O2I.*

Discussion:
Intel: Also correlation distance for the indoor-outdoor stage should be added with the value of 50 m.
Agreed with the addition: For the RMa scenario correlation distance for the indoor-outdoor state should be added with the value of 50 m.
Decision: The document is agreed

R1-164804 **Discussion on recommended split of low and high penetration loss for NR Samsung**

Proposal: For UMi, the low-loss model is used 80% probability and the high-loss model is used 20% probability; for UMa, the low-loss model is used 90% probability and the high-loss model is used 10% probability.

Discussion:
Ericsson: Having different probabilities in UMa and UMi is not in line with NR work.
Samsung: NR scenario don't have UMa and UMi mix. We should make suggestion to NR delegates.
Ericsson: BS above rooftop is UMa, below rooftop it is UMi.
Huawei: We are confused why we are discussing this. Channel model task is not to decide high or low loss.
Nokia: We sympathize the intention of this proposal but we should not have different probabilities for UMa and UMi.
CATT: We have similar view than Huawei.
Ericsson: We also agree with Huawei and CATT. One way could be to capture the recommendation. In the end this is simulation assumption.
Straight Path: There are reasons for the loss numbers in reality.
Decision: The document is revised in 5459

R1-165459 **Discussion on recommended split of low and high penetration loss for NR Samsung**
Discussion:
Decision: The document is withdrawn.

R1-165398 **Additional Considerations on Building Penetration Loss Modeling for 5G System Performance Evaluation Straight Path Communications**

Two options to model the mix of high-loss and low-loss building penetration models:
Proposal 1: The low loss model should be used with 80% probability, the high loss model should be used with 10% probability, and a medial loss model (the average of the high-loss and the low-loss model) should be used for 10% of the probability.
Proposal 2: The low loss model should be used with 80% probability and the high loss model should be used with 20% probability for Urban Micro; the low loss model should be used with 90% probability and the high loss model should be used with 10% probability for Urban Macro.
We request RAN1 to select one of these two proposals for New Radio (NR) system performance evaluation purposes.

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Discussion:
Decision: The document is not treated

Rural Macro model

R1-164712 Penetration loss measurements for RMa settings Qualcomm Incorporated

Proposal: Adopt the low-loss model from R1-161636 [4] to capture the shadow fading standard deviation for building penetration in an RMa setting, as suggested in R1-163909 [1].

Discussion:
Decision: The document is not treated

R1-164975 New measurements at 24 GHz in a rural macro environment Telstra Corporation Limited, Ericsson

Proposal: Extend the applicability of the new RMa path loss model in R1-163909 ***Error! Reference source not found.*** *to 24 GHz*

Proposal: Consider extending the applicability of the new RMa fast fading model in R1-163909 ***Error! Reference source not found.*** *to 24 GHz*

Discussion:
Fraunhofer: Lot of parameters are not investigated for this frequency range. This proposal is based on single measurements only.
Huawei: Scope of RMa is below 7 GHz.
Telstra: We want to challenge that approach.
Straight Path: We agree with Telstra. In the end the channel model does not matter. You need to design your system up to 100 GHz.
Huawei: ITU considered above 24 GHz.
Telstra: We did measurement on 24 GHz but that can be updated also to higher frequencies.
Fraunhofer: We don't have not enough data to conclude this.
Nokia: Figure 2, what is the difference between rural and suburban areas?
Ericsson: This is single measurement campaign but not much less than others like urban macro model.
CMCC: It is good to see results. We should match with practical deployments.
Decision: The document is revised in 5732

R1-165732 Way Forward for RMa model frequency range Telstra Corporation Limited, Ericsson

Discussion:
CMCC: This is not good way to extend the model based on only one measurement results.
Ericsson: Urban macro has been changed based on 2 measurements. This is more reasonable than UMa.
Huawei: How well the measurement results correlate with the low frequency of the IMT-A?
Ericsson: Parameters are the same than < 7 GHz.
Huawei: IMT-A was defined based on one measurements in Tyrnävä near to Oulu, Finland which is the flat terrain.
Telstra: We are surprised with this discussion.
Ericsson: If IMT-A was based on single measurement could we do the same also for this.
CMCC: There were lot of measurements for IMT-A e.g. in Winner.
Nokia: Do we intend to add a note to PL model?
Ericsson: Model is valid up to 30 GHz. It is only for the PL model.
Decision: The document is revised in 5769

R1-165769 Way Forward for RMa model frequency range Telstra Corporation Limited, Ericsson

Proposal: Extend the applicability of the RMa model to 30 GHz for pathloss, noting that:

- *All fast fading aspects remain applicable to 7 GHz*
- *Pathloss model validation above 7 GHz is based on a single measurement campaign conducted at 24 GHz*
  - *This sentence will be captured as a footnote to the pathloss table in the TR*

Discussion:
Huawei: This version is better now.
Decision: The document is agreed.

R1-165344 WF on O2I penetration for the RMa scenario Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

Proposal 1: Adopt a car penetration loss of 9 dB on average with a 5 dB standard deviation
Note: This model is valid for at least 0.6-60 GHz

Proposal 2: Include an optional car penetration loss model for metallized windows with 20 dB on average with a 5 dB standard deviation

Proposal 3: Adopt the low loss model for building penetration in the RMa scenario

Discussion:

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LGE: Proposal 2. When the option would apply?
Ericsson: Optional in the future SI/WIs.
Huawei: Why frequency range upper limit is 60 GHz? Is this frequency dependent?
Ericsson: It mean at least 60 GHz.
Qualcomm: We also have measurement results in our document.
Straight Path: Optional model is a good idea but situation may change with mixed windows.
CMCC: It is good to have optional model.
Fraunhofer: In car penetration model up to 60 GHz are specific to RMa.
Decision: The document is agreed

Correlations

R1-165343 Clarifications on channel model correlations Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

Proposal 1: UEs on different floors have uncorrelated LSPs
Proposal 2: LSPs for links from different sites to same UE are uncorrelated
– Clarify this directly in the TR rather than by reference
– Applies also to LOS/NLOS state but not indoor/outdoor state
Proposal 3: LSPs for links from co-sited sectors to same UE are fully correlated
– Clarify this directly in TR rather than by reference
– The outcome of steps 1-9 should be identical for all sectors

Discussion:
Decision: The document is agreed

R1-165350 Clarifications on frequency correlation Ericsson, AT&T, ETRI, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

Proposal: Cluster delays and angles are frequency-independent

Discussion:
Huawei: In many cases you can see similar delays but they are not always frequency independent. This is important topic but maybe too simplified approach.
Nokia: We don't have procedure to address this proposal in TR.
Ericsson: This may be simplification but pretty close to reality.
Samsung: We need to see what parameters are meant to be frequency-independent.
LGE: We agree with Samsung. This is too high level.
Fraunhofer: Cluster delay could vary over frequency.
Ericsson: Delay spread is in a way a dispersion of the channel.
Straight Path: We understand the intention but also agree with Samsung.
Decision: The document is noted

R1-165481 WF on frequency correlation Ericsson, ETRI, Telstra Corporation Limited

- *Proposal 1: Step 1 is identical for all frequencies, except:*
  - *1d Antenna patterns and array geometries*
  - *1g System centre frequency and bandwidth*
- *Proposal 2: Step 2 is identical for all frequencies,*
  - *Note: Soft LOS states may be different due to frequency dependent function*
- *Proposal 3: If blocking is modeled, the positions of blockers are the same for all frequencies*
  - *Note: The blocking loss may be different*
- *Proposal 4: Step 4 is identical for all frequencies, except for possibly frequency-dependent scaling of e.g. delay spread and angular spreads according to the LSP tables*
- *Proposal 5: The cluster delays and angles resulting from steps 5-7 are same for all frequency bands*
- *Proposal 6: Per-cluster shadowing (Zn in step 6) is independent for different frequency bands*
- *Proposal 7: Cluster powers in step 6 ~~are derived from the delay and angle spreads and~~ may be frequency-dependent*
- *Proposal 8: Steps 8-11 are independent for different frequency bands*

Discussion:
ZTE: WE are basically fine except with proposal 7.
Ericsson: We could change the wording like shown above in these minutes
Samsung: We need more time to look this late contribution.
Decision: The document is agreed with the modifications by red text above.

7.2.2 Remaining details on fast fading modelling for >6 GHz

Rural macro channel model

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R1-164386 **Discussion on Rma channel model** **Huawei, HiSilicon**

The following problems are necessary to be further investigated:

Problem1: the difference on the surrounding may bring difference on the ZSA for RMa.
Problem2: the difference between the RMa and UMa environment may bring disorder on the inside correlation when combine the RMa azimuth and UMa zenith cross-correlation parameters together.
Problem3: the difference on the surrounding may bring difference on the cluster ZSA for RMa.
Problem4: the difference between RMa and UMi and UMa may bring difference on the correlation distance in zenith domain for RMa.

Discussion:
Decision: The document is not treated

Large scale parameters

R1-164049 **Discussion on removal of square bracket for LSP** **Huawei, HiSilicon, Samsung**

Proposal1: the square bracket on the frequency dependent LSP in **Error! Reference source not found.** *except K-factor can be removed.*
Proposal2: Modify the K-factor parameters to reuse the values from M.2135 as in Table 1 and remove the square bracket.

Discussion:
ZTE: K-factor change is not only frequency dependent. This is fundamental change. Motivation is not clear.
Huawei: In some cases K-factor can be negative. Most of the cases the K-factor shall be positive.
Ericsson: We don't agree with having frequency dependent parameters.
Decision: The document is noted

R1-164730 **Cross-correlation on LSP for Indoor office** **Huawei, HiSilicon, AT&T, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Alternative 1: the cross-correlation on LSP for indoor office in Table 2 will be adopted.
Alternative 2: the cross-correlation on LSP for indoor office in Table 3 will be adopted.
Proposal 1: Adopt Alternative 1 or Alternative 2 for cross-correlation on LSP for indoor office.

Discussion:
Huawei prefers alternative 1.
LGE prefers alternative 1.
Ericsson prefer alt 2 but also OK with alt 1.
Samsung prefer alt 2 but also OK with alt 1.
Agreement: Alternative 1: the cross-correlation on LSP for indoor office in Table 2 will be adopted.
Decision: The document is noted.

R1-164570 **Remaining issues on fast fading modeling** **LG Electronics**

Proposal 1: Choose either approach 1 or 2 for the cross-correlation matrix in UMa and UMi-Street canyon O-to-I scenarios. In case approach 1 is preferred, the table in Appendix A can be used for revising the current cross-correlation matrix.
Approach 1: Adjusting cross-correlation values to ensure that the cross-correlation matrix is positive definite.
Approach 2: Reusing the cross-correlation matrix from TR 36.873 [2].
Proposal 2: Reuse the ZSD and ZoD offset parameters from TR 36.873 for necessary parameters above 6 GHz.
Proposal 3: After determination of the ZSD and ZoD offset parameters, the scaling factor should be defined based on the determination.
Proposal 4: Reuse the mean and standard deviation of XPR from TR 36.873 for necessary parameters above 6 GHz.

Discussion:
Decision: The document is not treated

R1-164805 **Remaining issues on UMi/UMa large-scale parameters** **Samsung, AT&T, Ericsson, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, ETRI**

Proposal 1: Reuse the mean and standard deviation of XPR parameters from TR36.873 model
Proposal 2: Adopt the cluster DS as fixed number, 5 for LoS and 11 for O2I
Proposal 3: Modify the per-cluster SF parameters to 3 dB for both UMi LoS and NLoS adopting from TR36.873
Proposal 4: Reuse ZoD spread and ZoD offset for UMi O2I and UMa O2I from UMi O2O and UMa O2O, respectively
Proposal 5: Adopt the revised cross-correlation parameters for O2I scenarios in Table 4
Proposal 6: Remove square brackets in Table 1 UMi channel parameters, if there is no other proposal to update

Petitioners' Exhibit 1007, p. 1960
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Discussion:
Ericsson: Proposal 6 means other proposals in this meeting.
Decision: The document is agreed

R1-165345 **WF on RMa LSPs** **Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Proposal 1: For in-car and indoor users, reuse LSPs for outdoor users according to the working assumption
– Note: These parameters are in Appendix A in R1-163909
– Note: Car and building penetration loss should be added for these users
Proposal 2: Adopt the following revised cross-correlation entries for LOS
– ZSD vs DS: 0
– ZSD vs ASA: 0
– ZSA vs ASA: 0

Discussion:
LGE: Parameters for indoor UEs?
Ericsson: We use outdoor parameters.
Decision: The document is agreed

R1-165569 **WF on ZoD offset for Indoor office** **Huawei, HiSilicon, Ericsson, Nokia, NTT DOCOMO, NTT, Samsung**

The ZoD offset for indoor office can be set as 0 for both LOS and NLOS cases

Discussion:
Decision: The document is agreed

Small scale parameters

R1-164388 **Discussion on removal of square bracket for cluster level SSP** **Huawei, HiSilicon, AT&T, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Proposal 1: the square bracket on the cluster level SSP in **Error! Reference source not found.** *can be removed.*
Proposal 2: the scaling factors for AOA, AOD generation in TR 36.837 can be reused for InH.
Proposal 3: the scaling factors for ZOA, ZOD generation in InH can be adopted as in **Error! Reference source not found.**.

Discussion:
Ericsson: 4 clusters are far too low.
Huawei: This value is based on results from different companies.
Samsung: What is alternative?
Ericsson: Clusters as in IMT-A, 15 clusters. We have tdoc 5353.
ZTE: We support Ericsson proposal. Number of 4 do not match with link level simulations.
Huawei: IMT-A values are based on below 6 GHz.
Samsung: We don't have all parameters in place in IMT-A.
Decision: The document is revised in 5460

R1-165460 **Discussion on removal of square bracket for cluster level SSP** **Huawei, HiSilicon**

Discussion:
NTT DOCOMO: We have measurement results supporting this.
Decision: The document is agreed

Frequency dependency

R1-164732 **Discussion on frequency dependent channel characteristics for InH and UMi** **Huawei, HiSilicon, CMCC, ETRI, Intel, Samsung, Nokia**

Proposal: Frequency dependent channel characteristics should be included in the model of this SI, e.g. for delay spread and angular spread.

Discussion:
Decision: The document is revised in 5570

R1-165570 **Discussion on frequency dependent channel characteristics for InH and UMi** **Huawei, HiSilicon, CMCC, ETRI, Intel, Samsung, Nokia**

Proposal: Frequency dependent channel characteristics should be included in the model of this SI, e.g. for delay spread and angular spread.

Discussion:
Ericsson: All measurements are not fully comparable.

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Decision: The document is revised in 5461

R1-165351 Frequency-dependence of LSPs Ericsson, Telstra

Proposal: Use frequency-independent or weakly frequency-dependent functions for modeling LSPs

Discussion:
Huawei: We compared from different data sources independently. Those are comparable.
Ericsson: We and Fraunhofer gave reasoning in last meeting on the comparability of the measurement.
Huawei: Ericsson showed in other contribution that delays and angles are quite similar with different power levels.
Ericsson: There may be some sort of dependency but it is not linear.
Huawei: Even with same measurement campaign seems to lead to different findings.
Decision: The document is revised in 5480

R1-165461 WF on frequency dependent LSP Huawei, HiSilicon, Samsung, NTT DOCOMO

Discussion:
Ericsson: This is only for indoor. What about other scenarios?
Huawei: In this we address only indoor. We have agreement for other scenarios.
Ericsson: We have brackets in other scenarios. We are fine in principle with this but we should apply the same also for other scenarios.
Huawei: Other scenarios can be modified in other contributions.
Ericsson: We would prefer linear domain instead, not logarithmic. It would be easier to compare plots.
Decision: The document is revised in 5475

R1-165475 WF on frequency dependent LSP for indoor office Huawei, HiSilicon, Samsung, NTT DOCOMO

Discussion:
Ericsson: It is not only the slope change but also average value change. We do have a solution for this in 5480.
Nokia: We could remove all the brackets from LSP values in TR.
Ericsson don't agree with that approach.
Samsung: We need to solve this issue. Only 2 companies (Ericsson, Telstra) object.

Chair: How many companies can agree on removing the brackets from LSP for indoor and UMi? => Nokia, Samsung, Huawei, KT, LGE, ETRI, Alcatel Lucent Shanghai Bell, NTT DOCOMO (8 companies)

Ericsson could agree to remove brackets from indoor.
Nokia: UMi still in brackets?
Ericsson: Half dependency for UMi
Samsung: Apply Ericsson proposal for indoor and remove brackets from UMi.
Nokia: We can compromise with Samsung proposal.
Ericsson: As compromise we could take half the dependency for all the parameters.
Decision: The document is noted

R1-165480 WF on frequency-dependent LSPs Ericsson, Telstra

Proposal 1: Use the compromise solution between frequency-dependent and frequency-independent for all scenarios
Proposal 2: Change the frequency-dependent LSPs such that the value at 6 GHz equals the legacy value, and mandate that the LSP value is constant below 6 GHz
Proposal 3: Change frequency-independent LSPs to the legacy values

Discussion:
Nokia: proposal 1 say all the scenario but we already have agreements for UMa. This reopen parameters for some scenarios. We don't support to change agreements at this late phase. We should focus on parameters in brackets now.
Ericsson: We are open to change only some of the parameters. Proposal 3 also apply to all scenarios and parameters, not just one with brackets.
Huawei: We share the Nokia concerns on re-opening the parameters which are based on measurements.
Samsung: We have similar view than Nokia and Huawei.
Ericsson: Huawei have raised concern that models are inconsistent but not willing to change those.
Huawei: We agree there are inconsistencies but we have measurements results for high frequencies what is the focus on this SI. We agree with the problem but not with the solution.
Ericsson: This is only solution propose to this issue. If we don't agree we will stuck with this.
Huawei: This is a new approach making parameters for <6GHz based on higher frequency measurements.
Nokia: We share the Huawei view. Target is to make realistic CM for >6 GHz.
Ericsson: This is not a new feature. It is already included in the white paper and done also earlier.
KT: We agree with Huawei, Nokia and Samsung.
Telstra: This is pragmatic approach to make model consistent.
Decision: The document is noted

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Time varying parameters

R1-165218 Time-Varying Delays and Angles Keysight

Proposal 1: Replace the factor $\exp(j2\pi v_{n,m} \cdot t)$ *with* $\exp(j2\pi \sum_{k=0}^{K}(v_{n,m}(k\Delta T) \cdot \Delta T))$ *in the channel coefficient equation*

- *where* $t = k\Delta T$, ΔT *is the time sampling interval and* k *is a positive integer*

Proposal 2: Proposal 1 needs only to be considered in case the Doppler frequencies are time-varying. This could be due to:

- *Non-linear UE movement*
- *Time-varying angles of arrival due to spatial consistency modeling*

Discussion:
Ericsson: This is almost identical with our proposal. This is more complex. Does it also mean delta T need to be updated?
Decision: The document is noted

R1-165346 WF on modifying channel coefficient equation for time-varying Doppler frequencies Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

- *Proposal 1: Replace the factor* $exp\ j2\pi vn,m \cdot t$ *with* $exp\ j2\pi vn,m\ t \cdot t - ti\ exp\ j2\pi vn,m\ ti \cdot ti$ *in the channel coefficient equation*
  - *The phase shift at time* ti *is established as an anchor point and an incremental phase shift is applied*
  - *The anchor point should be updated sufficiently often so that* $vn,m\ ti+1 - vn,m\ ti \ll 1$
- *Proposal 2: Proposal 1 needs only to be considered in case the Doppler frequencies are time-varying. This could be due to:*
  - *Non-linear UE movement*
  - *Time-varying angles of arrival due to spatial consistency modeling*

Discussion:
Decision: The document is agreed

Clusters

R1-165352 On number of clusters and paths within clusters Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

Proposal: The observations in this contribution should be taken into account when deciding on the number of clusters and paths within clusters

Discussion:
Samsung: Do you have a specific proposal for the number? This is high level proposal.
Ericsson: We should have at least 400. For the high resolution maybe 1000 or 10000 would be required.
Samsung: We already agreed numbers for the other cases.
Huawei: Is this proposal for all scenarios?
Ericsson: Yes.
Huawei: Changing the number of clusters now is a major change. Proposed numbers are based on only these measurements. What kind of post processing was used in these measurements? Do you measure 10000 rays at the same time? Is the environment fixed?
Ericsson: 2 GHz BW with large antenna array was used.
Decision: The document is noted

R1-165474 WF on number of MPCs Ericsson, NTT DOCOMO

Discussion:
Huawei: There are many good aspects but we have also concerns. E.g. equation for AoD leads easily less than 1. It should never go below 3GPP 3D CM. Equations may also lead to very high number which means more complicated simulations.
Ericsson: We say the minimum value is 20. It may be good to have maximum value as well.
Huawei: There are 3 dimensions, how to spread those to delay, azimuth and elevation?
Ericsson: This WF is only for the number of paths.
Huawei: Some upper limit should be defined to reduce the simulation complexity.
Decision: The document is noted

R1-165476 WF on number of MPCs Huawei, HiSilicon

Discussion:
Samsung: Regarding the number we need to consider also simulation complexity.
Huawei: We think it is good to add some upper limit to reduce complexity.
Nokia: We could leave the number as simulation parameter. Companies could decide the value they use.
Huawei: No strong opinion on that but we need to remind the complexity.
Ericsson: We could give guideline on simulation parameter.

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Decision: The document is revised in 5771

R1-165771 WF on number of MPCs Huawei, HiSilicon
Discussion:
Nokia: Will this be in addition feature section?
Huawei: This is additional text to DCM for large BW and large array.
LGE: How about calibration?
Decision: The document is agreed with the addition: For calibration Nmax is 40.

7.2.3 Remaining details on modelling of additional features for >6GHz channel model

7.2.3.1 Remaining details on blockage modelling

R1-164193 Remaining details for blockage modeling Intel Corporation
Discussion:
Decision: The document is revised in 5405

R1-165405 Remaining details for blockage modeling Intel Corporation

Proposal 1: The additional shadowing of one blocker should consider the link between the transmitter and the blocker for indoor scenario as in equation (2-1).
Proposal 2: When calculating the additional shadowing on the LoS channel cluster, the blocker model including center and span, can still be built in the receiver's polar coordinate system. Then the blocker model in the transmitter's coordinate system can be derived by center ($\boldsymbol{\varphi_{Rx} - \pi, \pi - \theta_{Rx}, r_{Tx}}$), azimuth angular span $\boldsymbol{A_{Rx} r_{Tx}/r_{Rx}}$, zenith angular span $\boldsymbol{Z_{Rx} r_{Tx}/r_{Rx}}$.
Proposal 3: For NLoS channel cluster, a virtual transmitter can be assumed at the extension line of AoA/ZoA.
Proposal 4: The additional shadowing on the NLoS channel cluster can be calculated based on the link between virtual transmitter and receiver in the same way as LoS channel cluster.
Proposal 5: The distance between the virtual transmitter and the blocker can be randomly generated in the range of $[r_{Rx} \quad d_{Tx\to Rx} - r_{Rx}]$.
Proposal 6: The definition of LoS/Shadow region can be clarified, e.g. using figure 3, for knife edge model.
Proposal 7: The existent period of hand-held blockage can be modelled as a random variable with exponential distribution or uniform distribution. Or for simplicity, the existence/absence of hand-held blockage can be modelled as a discrete event for a given UE during the whole traffic transmission of this UE.
Proposal 8: The coherent distance to generate spatially consistent blockers need to be defined. It can be generated as the scenario dependent value, e.g. [5] meter for indoor scenario, and [10] meter for UMi/UMa/RMa.

Discussion:
Qualcomm: Proposal 1 is fine in principle. Simulations support shorter distances.
Samsung: In principle we agree with proposal 1. We have slightly different calculation method.
Ericsson: On proposal 7, how would we parametrise such a model?
Decision: The document is noted

R1-164713 Advantages of stochastic blockage model Qualcomm Incorporated

Document highlight the main advantages of the stochastic approach and provide a text proposal

Discussion:
Fraunhofer: Reasoning for K-values is confusing.
Samsung: Step c is FFS in TP. Do you have any specific proposal? This method may require too many parameters.
Qualcomm: We could modify the attenuation loss.
Decision: The document is noted

R1-164808 Remaining details on blockage modelling for above 6 GHz channel model Samsung

Proposal 1: Proposal B3 is preferred.
Proposal 2: Azimuth angles of blocking screens should be generated with spatial consistency, i.e. interpolation using correlated random variables. Elevation angles of blocking screens should be computed according to geometry.
Proposal 3: Sizes of angular blocking regions should be determined by Eq. (2)-(6).
Proposal 4: The number of blockage regions is modelled by a Poisson distributed random variable as Eq. (7).
Proposal 5: Proposal B5, i.e., knife edge based model should be used to compute attenuation of blockage.
Proposal 6: Proposal A7 is preferred.
Proposal 7: The blockage attenuation is constant during the blockage period. Linear transition periods of 0.01s are introduced at both sides of the blockage period. The average blocking period should be used in the simulation. The average blocking period is determined by Eq. (9)

Discussion:

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Ericsson: We don't agree with the complexity. We can use the same approach for blockers as for users.
Qualcomm: We need to consider also other parameters which increase the complexity.
Decision: The document is noted

R1-165347 WF on Blockage modeling Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

- Both approaches have their use cases
  - A (stochastic model) when a generic and computationally efficient blocking scenario is needed
  - B (geometric model) when a specific and more realistic blocking scenario is needed
- Proposal: Adopt both A and B as optional blocking models

Discussion:
ZTE: Approach A still has some parameters as FFS.
Nokia: We had to address all FFS points in this meeting so we propose this to be conditionally agreed
Ericsson: What is we can agree points only for one model?
Samsung agrees with Nokia.
Decision: The document is agreed

R1-165462 WF on dynamic blockage Qualcomm Incorporated, Intel, Samsung, Ericsson
Discussion:
Ericsson: We can agree but we need to note that parameter values on stochastic approach need further clarifications.
ZTE: We prefer the single solution but also OK with this approach. Companies should provide a TP in this meeting.
Qualcomm: We are working on that.
LGE: You just generate random distance. We are in general fine with option A.
Nokia: It is difficult to find different with already agreed WF. We could go directly for the TPs.
Decision: The document is noted.

7.2.3.2 Remaining details on spatial consistency modelling

Remaining issues

R1-164809 Remaining details on spatial consistency for above 6 GHz channels Samsung

Proposal 1: Use the proposed channel generation steps for user dropping.
Observation 1: The modelling of spatial consistency in the user mobility case may require recalculation of antenna patterns, which increases the complexity of channel simulation.
Proposal 2: If spatial consistency in mobility is considered, Method 1 or Method 2 should be used. Also, Method 2 is slightly preferred.
Under the working assumption of interpolation with correlated random variables, a method was proposed in [7], which is denoted as Method 1
Propose a new method (denoted as Method 2) to update channel parameters over time.

Discussion:
Ericsson: Proposal 1, companies may implement this differently. Method 2 is problematic approach.
Huawei: How about angle spreads in Method 1? Is it possible to merge these proposals?
Samsung: No
Decision: The document is noted

Time evolution

R1-164050 Dynamic modeling for time evolution Huawei, HiSilicon

Proposal 1: Adopt the model of time-variant angles given by equations (1)~(5) under the framework of spatial consistency model in [3].

Discussion:
Decision: The document is not treated

R1-164389 Cluster delay with time evolution Huawei, HiSilicon

Proposal 1: Adopt the correlation matrix method in (1) to slow down the varying rate of cluster delay

Discussion:
Decision: The document is not treated

R1-164726 Discussion on spatial consistency in 5G channel model in time variant case Huawei, HiSilicon

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Proposal 1: Considering these results we may define a maximum distance of movement for the time evolution before a new spatially consistent realization is drawn. The max. movement maybe in the range of a few meters, e.g. 5m. This distance however may depend on the distance d_{2D}.
Proposal 2: Consider an asymmetric behaviour for the angular changes to model local cluster angular change rates.
Discussion:
Decision: The document is not treated

Calibration

R1-164194 Calibration methodology for spatial consistency Intel Corporation

- Proposal 1: Spatial consistency can be calibrated as:
  - For each dropped UE, create one pair of positions according to **Error! Reference source not found.**. The first position is the dropped UE's position. The second position has fixed distance, e.g. 1 meter, from the first position.
  - Collect statistics from channel realization on each pair of positions.
  - For LOS/NLOS state spatial consistency, collect CDF of the LOS/NLOS state delta.
  - For cluster level spatial consistency, collect CDF of the mean channel angle difference using equation (1-2) for AOD/ZOD/AOA/ZOA.
- Proposal 2: For drop based MU-MIMO simulation, use the baseline model for spatial consistency.
- Proposal 3: If improvement of mobility based simulation is needed, use baseline model for initial UE dropping, followed by updating cluster delay using equation (5-1) and updating cluster angle with the limit of equation (5-2).
- Proposal 4: If moving between different channel states is modelled, define soft LOS/NLOS and indoor/outdoor states, and then path loss and fast fading channel are defined as a function of soft LOS/NLOS and indoor/outdoor states as in equation (7-1) and (7-2).

Discussion:
Huawei: The scope of this document is not clear. Only proposal 1 is for calibration. Is mobility also considered?
Intel: This propose also other details than calibration. Mobility relation is not agreed yet.
Nokia: We are OK in principle with dropping part for calibration.
Samsung is also OK with dropping part.
Huawei: WE have joint contribution in different agenda item
Decision: The document is noted

Further enhancements

R1-165233 WF on correlation distance for spatial consistency in RMa Intel, Ericsson, AT&T, ETRI, Huawei, HiSilicon, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

- *The correlation distance for cluster/ray specific random variables for RMa is according to the table below*
- *The correlation distance for LoS state is [60m] for RMa*

	RMa	
	LOS	NLOS
Correlation distance (m) for cluster/ray specific random variables	[50]	[60]

Discussion:
Nokia: We should remove the brackets.
Samsung: Same comment.
Chair: Brackets can be removed when implementing text into TR.
Decision: The document is agreed

R1-165234 WF on mobility enhancement for spatial consistency Intel, Ericsson, AT&T, ETRI, Huawei, HiSilicon, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung

Proposal 1: Both alternatives are captured in TR 38.900
- *Alternative 1: based on R1-163480, details described in the following slides*
- *Alternative 2: based on R1-163248, details described in the following slides*

Proposal 2: Modify the below text by adding the red text into the current TP
- *The cluster specific random variables include:*
  - » *Cluster specific random delay in step 5;*
  - » *Cluster specific shadowing in step 6; and*
  - » *Cluster specific offset for AoD/AoA/ZoD/ZoA in step 7.*
  - » *Cluster specific sign for AoD/AoA/ZoD/ZoA in step 7*

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- *The procedure shall apply to each cluster before sorting the delay. Cluster specific sign for AoD/AoA/ZoD/ZoA in step 7 shall be generated once kept unchanged per simulation drop if UE position changes during simulation. The ray specific random variables include:*

Discussion:
Samsung: Alternative 1, would it be possible to update cluster angles?
Ericsson: Alternatives are different in scope. We are fine with capturing both in TR but we need to consider how to do that.
Decision: The document is agreed

R1-165348 **WF on O2I spatial consistency Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

- Proposal 1: Determine the "building type" using a spatially consistent random variable with correlation distance [50 m]
  - The building type is determined by comparing the random variable with P1 and P2
- Proposal 2: Determine the indoor distance from a spatially consistent uniform random variable in the interval 0-25 m, with correlation distance [25 m]
- Proposal 3: Make the penetration loss variability sP a spatially consistent random variable with correlation distance [10m]

Discussion:
Fraunhofer: What is the value in proposal 3?
Ericsson: Same as the Shadow fading.
Decision: The document is agreed

R1-165354 **WF on further enhancements for spatial consistency Ericsson, Intel, AT&T, ETRI, Huawei, HiSilicon, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

- Proposal 1: Soft LoS states are modeled in spatial consistency modeling
  - Soft LoS state is a float number between 0 (NLoS) and 1 (LoS)
  - Soft LoS state generating method is according to the appendix
    - dLoS is [20]
  - Define path loss and channel matrix to be a function of soft LoS state
    - $PLLOSsoft = PLLOS \cdot LOSsoft + PLNLOS \cdot (1 - LOSsoft)$
    - $HLOSsoft = HLOS \cdot LOSsoft + HNLOS \cdot 1 - LOSsoft$
  - Note: Not restricted to mobility simulations only
- Proposal 2: Soft indoor/outdoor states are not modeled in spatial consistency modeling
  - Note: The model thus doesn't support move between indoor/outdoor states in mobility simulation

Discussion:
LGE: Agreement from last meeting was different.
Ericsson: This is a shared view from sourcing companies.
Samsung: We shall remove the brackets when implementing this in TR.
Decision: The document is agreed

R1-165773 **TP for blockage Qualcomm, Intel, Samsung, Ericsson**
Discussion:
Fraunhofer: have you considered if you move the screen and elevation change?
Straight Path: Situation is different in NLOS case.
Decision: The document is noted.

7.2.3.3 Remaining details on large antenna array modelling

R1-164727 **Discussion on remaining details on large antenna array modeling Huawei, HiSilicon**

Proposal 1: The following aspects on large array support should be discussed in the channel model SI: spherical wave, high angular resolution, 3D correlation issue, and non-stationarity.
Proposal 2: The spherical wave modeling introduced in this document should be taken into account in the channel model SI.

Discussion:
Ericsson: What do you mean by 3D correlation issue?
Huawei: Contribution [6] discuss that.
Samsung: Do you have concrete proposals?
Huawei: Spherical way proposal is in this document. Other issues are ongoing except non-stationary. That can be discussed this week further.
Ericsson: Would it be in space domain?
Huawei: Yes.
Ericsson not comfort able with proposal 2.

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Decision: The document is noted

R1-165183 **Implementation of cluster delay and angle spread NTT DOCOMO, INC., AT&T, Ericsson, Huawei, HiSilicon, Intel, KT Corporation, Nokia, Qualcomm, Samsung**

Alternative 1: Implementation for narrow BW based on sub-cluster information of 3GPP 3D model
Alternative 2: Implementation for large BW and/or large antenna arrays using generating step of cluster delays and angles in the 3GPP 3D channel model
Alternative 2a: Method using generating step of cluster delays and angles in the 3GPP 3D channel model
Alternative 2b: New method
Proposals 1: Adopt Alternative 1 for low complexity simulations where narrow BW
Proposals 2: Down select from Alternative 2a and Alternative 2b for large BW and/or large arrays

Discussion:
NTT DOCOMO support 2a.
Ericsson support 2b.
ZTE support 2b.
Decision: The document is revised in 5466

R1-165466 **WF on implementation of cluster delay and angle spread NTT DOCOMO, Huawei, HiSilicon, Intel, Nokia, Qualcomm, Samsung**

Proposal 1: Alternative 1 is adopt for low complexity simulations where narrow BW
Proposal 2: Alternative 2a is adopt for large BW and/or large arrays

Discussion:
Ericsson: Alternative 2a is based on number of paths not in line with other WF. We like to see the scaling.
ZTE: Proposal is quite high level. It would be better to provide TP.
Decision: The document is revised in 5477

R1-165477 **TP for implementation of cluster delay and angle spread in TR38.900 on Clause 7.5 NTT DOCOMO, Huawei, HiSilicon, Intel, Nokia, Qualcomm, Samsung**

Discussion:
LGE: Comments on 3 issues. How to use scaling factor? How to implement cluster delays in section 7.5? This is a new feature for large antenna array. How RAN1 us this new feature?
NTT DOCOMO: We will assume arrays. Clause belongs for rapporteur to handle.
Samsung: We prefer to capture in 7.6 instead.
LGE: New delay offset for narrow BWs.
ZTE: 2 values are not defined yet. Who will provide those definitions? Scaling factor is non-linear optimisation factor. Companies are not sure about realization.
Fraunhofer: What to do with sub path powers?
Ericsson: Which agreement in Busan this is referring to? We could re-use agreed TP for the hybrid model.
NTT DOCOMO: WF in this meeting.
Decision: The document is revised in 5772

Friday

R1-165772 **WF on implementation of cluster delay and angle spread Ericsson, NTT DOCOMO, ZTE Corp, ZTE Microelectronics**

Discussion:
Decision: The document is agreed.

R1-166025 **WF on AoA, ZoA, ZoD Angular Scaling Huawei, HiSilicon, NTT DOCOMO**

- Agree the following example values for scaling:
  - AoA spread (ASA) for each CDL model: {30, 45, 60} degrees.
  - ZoA spread (ZSA) for each CDL model: {5, 10, 15} degrees.
  - ZoD spread (ZSD) for each CDL model: {1, 3, 5} degrees.

Decision: The document is agreed.

R1-165353 **Indoor Highly Resolved Channel Measurements at 60 GHz Ericsson, Telstra**

Observation 1: 1000-10000 MPCs needed to account for 95% of power
Observation 2: 100 strongest MPCs account for 10-70% of power
Observation 3: Number of observed clusters are at the order of 10-20
Observation 4: More clusters and MPCs needed in NLOS than in LOS

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Proposal: The observations in this contribution are taken into account when deciding on the number of clusters and paths within clusters

Discussion:
Huawei: BW is 2 GHz with very large array. How did you consider the impact of that?
Ericsson: Broadening the clusters.
Decision: The document is noted.

7.2.3.4 Remaining details on modelling of other additional features

R1-164353 **Text proposal to update oxygen absorption loss ZTE**
Discussion:
Decision: The document is agreed

7.2.4 Remaining details on link-level channel models

Remaining issues

R1-164724 **Discussion on the link level channel models Huawei, HiSilicon**
Proposal 1: CDL-A/TDL-A two last tap powers adjusted 19.0 to -19.9 and -33.1 to -29.7.
Proposal 2: CDL-D/CDL-E/TLD-D/TDL-E delay spread is adjusted by multiplying all delays by a constant value to obtain 1.0000 rms delay spread.
Proposal 3: Correct the editorial error of CDL-D.
Discussion:
Decision: The document is agreed

TPs and WFs

R1-164051 **Text proposal to TR 38.900 to add link level channel model for LoS scenario Huawei, HiSilicon**
Discussion:
Decision: The document is agreed

R1-164052 **Text proposal to TR 38.900 to add antenna filtering for link level channel model Huawei, HiSilicon**
Discussion:
Fraunhofer: We had email discussions where we said there is something wrong in this. Filter has to be changed.
Huawei: This is a copy of agreed WF from Busan.
Decision: The document is revised in 5468

R1-165468 **Text proposal to TR 38.900 to add antenna filtering for link level channel model Huawei, HiSilicon**
Discussion:
Samsung: We have not got time to check.
Decision: The document is return.
Friday: The proposed TP is just noted.

R1-164257 **Text Proposal on the purpose of link-level channel modes for 38.900 CATT**
Discussion:
Samsung: This is more a guideline for NR, not for channel model work.
CATT: WE have used similar statement also earlier SCM channel model work.
LGE: We are not sure why we have to capture this in a TR.
Huawei: This is not necessary text in a TR. It is up to RAN1 to decide which model to use.
Ericsson: This is not something we should mandate. We could have recommendation or guideline.
Decision: The document is noted

R1-164725 **Text proposal to TR 38.900, corrections and clarifications to the link level channel models Huawei, HiSilicon**
Discussion:
LGE: Comment on CDL table delay.
Huawei: Delay is normalised to 1 s.
CMCC: Do we have to align the numbers with system simulation parameters?
Huawei: These are different models agreed before system simulation model due to time pressure.
Decision: The document is agreed

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R1-164731 **Scaling of the K-factor of the link level channel models** **Huawei, HiSilicon, Nokia, Samsung, AT&T, CMCC, Ericsson, Intel, KT Corporation, NTT DOCOMO, Qualcomm**
Discussion:
Decision: The document is revised in 5440

R1-165440 **Scaling of the K-factor of the link level channel models** **Huawei, HiSilicon, Ericsson, Nokia, Samsung, Intel, Qualcomm, NTT DOCOMO, AT&T, KT Corporation**
Proposal: The above procedure for K factor scaling and example K-factor values is added into the TR 38.900.
Discussion:
Decision: The document is agreed

R1-165349 **WF on link level models for MIMO simulations** **Ericsson, AT&T, CMCC, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**
Discussion:
Decision: The document is revised in 5402

R1-165402 **WF on link level models for MIMO simulations** **Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**
- Proposal 1: Introduce angular translation and angular spread scaling to the agreed CDLs
  - A method for scaling and translation to be described in the TR
  - Guidelines on selecting scaling and translation parameters to be captured in the TR
  - Note: This can be done with a similar approach as the delay scaling
- Proposal 2: Introduce correlation matrices to be used together with the TDLs
  - The correlation matrix construction method from 36.101/36.104 can be reused
  - Guidelines on selecting correlation parameters to be captured in the TR
  - Note: This approach can be applied to TDLs derived from spatially filtered CDLs according to R1-163490 to emulate hybrid BF

Discussion:
Samsung: Are we going to capture the content in the TR? Angular spread need to be modified.
Ericsson: Typo need to be fixed.
Huawei: There should be example scaling factor values in proposal 1. We are preparing WF for that. Proposal 2 for channel or cluster correlation matrix? How it is defined for very large array? 4x4 MIMO leads to 16x16 correlation matrix. We could have 256x256 MIMO and the matrix will be huge.
Ericsson: It can be used for both. Per channel may be better but we are open for both. We don't need to write out the matrices.
Samsung: Proposal 2 2nd bullet needs clarification.
Ericsson: It is defined in the 3rd bullet.
Decision: The document is revised in 5470

R1-165470 **WF on link level models for MIMO simulations** **Ericsson, AT&T, ETRI, Huawei, HiSilicon, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung, InterDigital**
Discussion:
Decision: The document is agreed

R1-165756 **WF on Angular Scaling** **Huawei, HiSilicon, Ericsson**
Agree the Proposal 1 of R1-165402.
Agree the following example values for AoD spread (ASD) for each CDL model: {5, 10, 15, 25} degrees.
Scaling of other angular parameters (ZSD, ASA, ZSA) are FFS.
Discussion:
Samsung: Did you address the zenith angle?
Huawei: That is quite limited case. The scalability of that is not important.
Samsung: We should define the upper limit. We should not have FFS anymore.
ZTE: Is the scaled number already normalized.
Huawei: Proposal was to first normalise, then scale.
Samsung: We should complete FFS and zenith angle during this week.
Decision: The document is agreed.

7.2.5 Channel modelling calibration results

R1-165184 **Further Discussion on O-to-I Parameters** **NTT DOCOMO, INC.**
Discussion:
Decision: The document is revised in 5427

Petitioners' Exhibit 1007, p. 1970
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R1-165427 **Further Discussion on O-to-I Parameters NTT DOCOMO, INC.**

Proposal 1: Use the UE-specific in d_{in}, i.e. UE to all the sectors has the same d_{in}.

Proposal 2: Replace the O-to-I shadow fading with O-to-I standard deviation.

Discussion:

Decision: The document is noted

R1-165770 **WF on calibration Nokia, Samsung**

- *Setup 3 email threads for collecting calibration results*
  - *For updating results for large scale calibration: Until June 10th*
  - *For full calibration results: Until June 25th*
  - *For additional feature calibration: Until July 25th*
- *Companies can decide which option(s) to calibrate for those additional features with multiple options*
  - *Rapporteur will provide separate excel templates for different options*
- *Capture the [reference tdoc # containing the excel sheet(s)] into TR38.900 similarly to 3D channel model calibration process*
  - *TP for capturing the results can be approved in the email discussion*

Discussion:

Decision: The document is agreed.

7.2.5.1 Large-scale calibration

Email discussion summary

R1-164802 **E-mail discussion summary of the large scale calibration Samsung, Nokia**

Large-scale calibration is completed, and the calibration results in the latest version of the excel sheet in the ftp folder are captured in the TR.

- *In the TR, average cdf plots will be provided for the calibration parameters with citing rapporteur's calibration summary tdoc similarly as done for TR36.873.*
- *In the rapporteur's calibration summary tdoc, the below table on the O2I parameters is included.*

For the full calibration, companies continue discuss how to align the three O2I parameters in [84b-17].

Discussion:

Decision: The document is agreed

Calibration results

R1-164195 **Large scale calibration results Intel Corporation**

Discussion:

Decision: The document is not treated

R1-164258 **Large scale calibration results CATT**

Discussion:

Decision: The document is not treated

R1-164384 **Discussion on large-scale calibration Huawei, HiSilicon**

Discussion:

Decision: The document is not treated

R1-164571 **Large scale calibration results LG Electronics**

Discussion:

Decision: The document is not treated

R1-164810 **Results of large-scale channel model calibration Samsung**

Discussion:

Decision: The document is not treated

R1-164899 **Large Scale Calibration Results Beijing Xinwei Telecom Techn.**

Discussion:

Decision: The document is not treated

Petitioners' Exhibit 1007, p. 1971
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R1-165286 **Large scale calibration results of channel model for frequency spectrum above 6 GHz** **CATR**
Discussion:
Decision: The document is not treated

R1-165404 **Large scale calibration results** **Lenovo, Motorola Mobility**
Discussion:
Decision: The document is not treated

Calibration discussions

R1-164715 **Initial results on large scale calibration and concerns on calibration specifications** **Qualcomm Incorporated**

Proposal 1: Baselines on which large and full scale calibration are to be made need to be specified completely and in as much detail as possible in the TP to avoid ambiguities and mismatches in calibration curves.
Proposal 2: UE-specific, link-specific, eNB-specific and sector-specific quantities need to be appropriately defined.
Proposal 3: Quantities that are to be correlated across sectors, across eNBs and across links need to be specified. In particular, assumptions on the following quantities need to be specified: Outdoor/indoor determination random variable, penetration loss determination random variable, d_In, shadow fading factors for LOS/NLOS, and shadow fading factors for penetration loss.

Discussion:
Decision: The document is noted

R1-164894 **Discussion on large-scale calibration results** **CHTTL**

Proposal 1: RAN1 should clarify whether it's UE-specific or link-specific for Building penetration loss through external wall, O-to-I penetration loss standard deviation, and Indoor distance d2D-in to improve the convergence of calibration results.

Discussion:
Decision: The document is noted

7.2.5.2 Full calibration

Email discussion summary

R1-164803 **E-mail discussion summary of the full calibration** **Samsung**
Discussion:
Decision: The document is noted

Calibration results

R1-164259 **Full scale calibration results** **CATT**
Discussion:
Decision: The document is not treated

R1-164385 **Discussion on fast fading calibration** **Huawei, HiSilicon**
Discussion:
Decision: The document is not treated

R1-164811 **Results of full channel model calibration** **Samsung**
Discussion:
Decision: The document is not treated

Calibration discussions

R1-164048 **Discussion on additional feature calibration** **Huawei, HiSilicon, AT&T, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**
Discussion:
Decision: The document is revised in 5441

Petitioners' Exhibit 1007, p. 1972
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R1-165441 **Discussion on additional feature calibration** **Huawei, HiSilicon, AT&T, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Proposal 1: adopt assumptions in Table 1 for calibration of oxygen absorption.
Proposal 2: adopt assumptions in Table 2 for calibration of large bandwidth and large antenna array.
Proposal 3: adopt assumptions in Table 3 for calibration of spatial consistency.
Proposal 4: adopt assumptions in Table 4 for calibration of blockage.

Discussion:
Decision: The document is revised in 5469

R1-165469 **Discussion on additional feature calibration** **Huawei, HiSilicon, AT&T, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Proposal 1: adopt assumptions in Table 1 for calibration of oxygen absorption.
Proposal 2: adopt assumptions in Table 2 for calibration of large bandwidth and large antenna array.
Proposal 3: adopt assumptions in Table 3 for calibration of spatial consistency.
Proposal 4: adopt assumptions in Table 4 for calibration of blockage.

Discussion:
Nokia: There are quite many scenarios to calibrate. We should try to down select the scenarios and metrics.
LGE: Which spatial consistency dropping method is intended? Large antenna array have 64 elements. Distance of the panels will be more than 3.5 lambda. We have too many metrics to calibrate.
Huawei: In stationary case we drop multiple users at the same time. We could consider down selection.
Decision: The document is revised in 5471

R1-164900 **Discussion on full calibration** **Beijing Xinwei Telecom Techn.**

Proposal 1: Companies are encouraged to adjust cross correlation values based on measurement data to make the cross correlation matrix positive definite.
Proposal 2: Reuse the same ZSD and ZoD offset parameters for UMa and UMi-Street Canyon LOS O-I scenarios as those values for UMa and UMi-Street Canyon LOS scenarios, as listed in Table 1 and Table 2 .
Proposal 3: Reuse the same ZSD and ZoD offset parameters for UMa and UMi-Street Canyon NLOS O-I scenarios as those values for UMa and UMi-Street Canyon NLOS scenarios, as listed in Table 1 and Table 2 .
Proposal 3: For indoor-office scenario, ZoD offset in LOS condition can be zero, and in NLOS condition, it should be a function that takes d2D or d3D as a variable.
Proposal 4: Constant C for the number of clusters equals to 4, 10 or 11 should be defined based on measurement data.
Proposal 5: For calibration purpose, whether O-I penetration loss is high or low is UE-specific, indoor distance is UE-specific, and replace shadow fading term by standard deviation which is link-specific and the same for three sectors of an eNodeB and different for different eNodeBs.

Discussion:
Decision: The document is noted

R1-165471 **Discussion on additional feature calibration** **Huawei, HiSilicon, AT&T, Ericsson, Intel, KT Corporation, Nokia, NTT DOCOMO, Qualcomm, Samsung**

Discussion:
Decision: The document is agreed

7.2.6 Consistent extension of the additional features to < 6GHz

R1-164716 **Considerations on link and system model extension to < 6GHz** **Qualcomm Incorporated**

Observation 1: Typically, when a UE is close to the base station it is more likely to experience a relatively lower delay spread, compared to that of a UE that is in the cell-edge.
Proposal 1: Perform link-level evaluations of different numerology proposals under a geometry-based scaled multi-path channel model.

Discussion:
Decision: The document is not treated

R1-164728 **Discussion on the extensions of the channel model to below 6GHz** **Huawei, HiSilicon, Intel, Qualcomm**

Proposal: TR38.900 is applicable to 6 - 100 GHz only.

Discussion:
Ericsson: RMa would then be valid only between 6 – 7 GHz.
Huawei: It would be valid for lower frequencies too. One way would be to include RMa in 3D CM.
Nokia: RMa is anyway exceptions as it is only for up to 7 GHz.
Samsung: How can solve the discrepancy between models at 6 GHz?
Huawei: We can adjust higher frequency PL or modify 3D CM PL. We prefer option 1 to modify 5G CM PL.
Ericsson: Observation 4 shows additional features are important also for < 6 GHz.
Nokia: We don't think the PL discontinuity is a critical issue.

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Ericsson: NR evaluation has such scenario combining both frequency ranges. Having different models is not a good solution.
Telstra: <6GHz range is important. 2 models is not a good approach.
Huawei: Basically we agree it would be good to have only 1 model but we have very limited time schedule. We would need more time to study all implications.
Decision: The document is noted

R1-164806 Discussion on using new channel model also below 6 GHz Samsung, AT&T, Ericsson, KT Corporation, ETRI
Discussion:
Decision: The document is revised in 5400

R1-165400 Discussion on using new channel model also below 6 GHz Samsung, Ericsson, ETRI, KT Corporation, Telstra
This contribution made the following observations:

- *If two incompatible pathloss models are adopted according to Alt 1, pathloss discontinuities occur at 6 GHz.*
- *Alt 1 can introduce another problem of how to handle the range of 3.5-6GHz frequency band.*
- *The new channel models are proposed based on the dataset including both below and above 6 GHz measurement/ray-tracing.*
- *Following Alt 1, there is no 3D channel model for InH and RMa scenarios below 6 GHz; With Alt 2, 3D channel model is available for all prioritized scenarios and frequency bands.*
- *There was a precedence to make a full transition from one channel model to another – TR 25.996 SCM to ITU channel models during 3GPP RAN1 LTE advanced SI.*
- *Alt 2 can improve the accuracy of MU-MIMO simulations below 6 GHz.*
- *Alt 2 may be more attractive from the point of view of ITU-R*

Discussion:
Huawei: PL model is shown as reasoning but the same can be used also another way around. Do we need to redo all the simulations?
Samsung: Interference limited scenario was considered in 3D CM work. PL change doesn't affect the results so much. We saw in calibration results that we have Interference limited scenario in NR as well.
Huawei: We should consider different levels in NR study. The impact on PL will be more significant.
Decision: The document is noted

R1-164807 Discussion on consistent pathloss model between below 6GHz and above 6GHz Samsung
Proposal 1:
– *Considering the simplicity and the consistency in pathloss models, Solution #2 should be taken into TR38.900*
Proposal 2:
– *Alt 2 : New channel model in TR38.900 is applicable to 0.5 - 100 GHz in R1-164616 should be down-selected*
Discussion:
Decision: The document is not treated

R1-164616 On the applicability range of new channel model Nokia, AT&T, Ericsson, ETRI, Huawei, HiSilicon, Intel, KT Corporation, NTT DOCOMO, Qualcomm, Samsung
RAN1 should down-select between the two alternatives
– *Alt.1: New channel model in TR38.900 is applicable to 6 - 100 Ghz*
– *Alt.2: New channel model in TR38.900 is applicable to 0.5 - 100 Ghz*
Discussion:
ZTE: There is also 3rd alternative.
Decision: The document is noted

R1-165472 WF on the applicability range of new channel model Nokia
Discussion:
Decision: The document is withdrawn

R1-165479 WF on the applicability range of the new channel model Ericsson, Samsung, Telstra, ETRI, KT, LGE, Straight Path
Proposal: New channel model in TR38.900 is applicable to 0.5 - 100 GHz
Discussion:

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Nokia: It is hard to find a compromise for the question yes or no. We could capture the new CM is applicable to at least 6-100 GHz.
Ericsson: There are colleagues in NR session planning to use this model for < 6GHz.
Huawei: We checked NR colleagues. If model is stable they can use it also, otherwise they use something else.
Ericsson: What is Huawei view? Is the model valid for <6 GHz or not?
Huawei: It is not valid for < 6 GHz.
CATT: Model is not valid for < 6 GHz. NR evaluations will start in the next meeting.
Nokia: There is no consensus for the values < 6GHz. We capture now what we have in a TR and add a sentence in the TR and close the SI.
Ericsson: That would be extremely confusing for NR evaluations. We need to solve this before closing the SI.
Huawei: NR assumption says also 3D model can be used. Title of the SI is > 6 GHz so this is very clear.
Ericsson: Why do you draft WF for link level which is mandatory for < 6 GHz?
Samsung: Current TR have different description for different features and applicability range. Link level is OK. It would be much nicer to use the 5G CM for the whole range of NR.
CMCC: We have not got enough time to evaluate parameters for < 6 GHz. If to cover also that then extension of the SI should be further discussed.
Samsung: There is no issue to use this for < 6GHz. There is no CM agreed for all NR simulation cases.
Telstra: This is important issue to solve.
Samsung: What is Huawei solution for indoor?
Huawei: Using 3D CM or ITU model.
Samsung: ITU model is not 3D.
Ericsson: Partial solution would be to agree extension to UMa and RMa.
Huawei: What is the reason to extend if UMa is according to 3D CM and RMa according to ITU?
Ericsson: We have re-used parameters and added some more parameters.
Samsung: Compromise could be to have applicability range in brackets and let NR to decide.
Huawei: RAN plenary discussed this range. We proposed then to cover the full range but it was objected by many companies. The whole SI focus have been >6 GHz only.
Samsung: We are not changing any opinion but consider extending to <6GHz as discussed in the plenary.
Ericsson: There are many issues to solve for <6GHz.
Ericsson: We have proposed solution to solve this issue. Blocking is not constructive.
CATT: We have not seen solution for extension.
Conclusion: 2 alternatives were discussed on the applicability frequency range either 0.5-100 GHz or 6-100 GHz but consensus was not reached.
Decision: The document is noted.

7.2.7 Map-based methodology

R1-164351 Evaluations of map-based hybrid channel model ZTE, Keysight

Proposal 1: RAN1 confirms the working assumption on map-based hybrid model in TR38.900

Discussion:
Huawei: Did you verify the spatial consistency between 2 closely located users? It seems to be good match between parameters. Why the SF is lower?
ZTE: Not in this document but we have done that earlier.
NTT DOCOMO: Question on Figure 2 calibrated PL decrease.
Ericsson: Do you think table 2 shows a good correspondence?
ZTE: On reason for the difference is the layout. Ray tracing results will be smaller than stochastic model. Hybrid model works with different maps.
Ericsson: Is the different from the map only?
ZTE: Yes. There are differences in results also in stochastic model.
Decision: The document is agreed

R1-164352 Text proposal for remaining issues in map-based hybrid model ZTE, Keysight

Discussion:
Decision: The document is revised in 5667

R1-165667 Text proposal for remaining issues in map-based hybrid model ZTE, Keysight

Proposal 1: The modeling of large bandwidth and large antenna array in map-based hybrid channel model is based on the splitting of whole bandwidth into multiple frequency bins, and has channel coefficients per bin given by (1) and corresponding delays given by (2).
Proposal 2: The modeling of blockage and UT rotation in map-based hybrid channel model obeys maximum similarity to those determined in stochastic-only model.
Proposal 3: To update the section 8 of TR38.900 with the attached TP.

Discussion:

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Ericsson: Dividing the BW. Is this applicable to both models?
ZTE: In theory yes but the intention is to have that only in hybrid model.
Ericsson: If to have it in both models then more time is needed to evaluate.
Decision: The document is agreed.

8 Closing of the meeting

Thanks to the Chineese Friends of 3GPP for hosting and organizing such big meeting. High attendnace will surely becomes an issue for the upcoming meetings in Europe.
Mr Chair thanked all the chair persons who help managing the number of parallel sessions during the course of the week. Good progress was achieved with the closing of NB-IoT work and other WI/SI as well.
Mr Chair then wished all a relaxing summer break.
Meeting was closed at 17:10.
See you all in Göteborg.

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Annex A: List of Tdocs at RAN1 #85

Please see excel file attached to this report

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Annex B: **List of CRs agreed at RAN1 #85**

TDoc #	Title	Source	Release	Spec #	Version	Related WIs	CR #	CR revision #	CR category

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Annex C-1: List of Outgoing LSs from RAN1 #85

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-165511	LS on RAN1 multi-carrier enhancements for UMTS agreements	RAN1, Huawei	Rel-14	FS_UTRA_Mce		RAN2, RAN3			
R1-165512	LS on HS-SCCH DRx Design in Cell Fach	RAN1, Qualcomm	Rel-14	FACH_DTXDRX-Core		RAN2, RAN3			
R1-165710	Reply LS on TBS sizes for SI-messages for NB-IoT	RAN1, Huawei	Rel-13	NB_IoT-Core	R2-163294	RAN2			
R1-165711	Reply LS on updated TS 36.300 section 5 for NB-IoT	RAN1, Huawei	Rel-13	NB_IoT-Core	R2-161885	RAN2			
R1-165748	LS on MPDCCH configuration for BL/CE UE	RAN1, Ericsson	Rel-13	LTE_MTCe2_L1-Core		RAN2			
R1-165814	LS to RAN2 on Priority for V2V	RAN1, Qualcomm	Rel-14	LTE_SL_V2V-Core		RAN2	SA2		
R1-165820	Reply LS on Parameters for WP5D Sharing and compatibility studies	RAN1, NTT DOCOMO	Rel-15	FS_NR_newRAT	R4-162880	RAN4			
R1-165853	LS on OTDOA for the same PCI	RAN1, Huawei	Rel-14	UTRA_LTE_iPos_enh2-Core		RAN2, RAN3	RAN4		
R1-165906	LS on RRC parameter list for NB-IoT	RAN1, Huawei	Rel-13	NB_IoT-Core		RAN2			
R1-165913	LS on TR update for latency reduction	RAN1, Ericsson	Rel-14	FS_LTE_LATRED		RAN2			
R1-165984	LS on RAN1 Agreements in MUST	RAN1, MediaTek	Rel-14	LTE_MUST-Core		RAN4			
R1-165996	Reply LS on the feasibility of mobility enhancement solutions	RAN1, ZTE	Rel-14	LTE_eMob-Core	R2-163135	RAN2	RAN4, RAN3		
R1-166029	LS on Rel.14 eFD-MIMO WID update	RAN1, Nokia	Rel-14	LTE_eFDMIMO-Core		RAN			
R1-166033	LS on high level coexistence approaches between PC5 transport for V2V services and DSRC/IEEE 802.11p services in the same channel	RAN1, Ericsson	Rel-14	FS_LTE_V2X		RAN			
R1-166044	LS on Uplink Capacity Enhancements for LTE	RAN1, Ericsson	Rel-14	LTE_UL_CAP_enh-Core		RAN2	RAN4		
R1-166037	LS on NB-IoT performance	RAN1, Huawei	Rel-13	NB_IoT-Core		RAN	RAN2, RAN4		
R1-166038	LS on DRX and Reception of PDCCH scrambled by CC-RNTI	RAN1, Panasonic	Rel-13	LTE_LAA-Core		RAN2			
R1-166040	Response LS to 802dot11 regarding LAA	RAN1, Qualcomm Incorporated	Rel-13	LTE_LAA-Core		IEEE 802 LAN/MAN Standards Committee	Wi-Fi Alliance, The City of New York Office of the Mayor, RAN, RAN2, RAN4		
R1-166041	Response LS to WFA regarding LAA	RAN1, Qualcomm Incorporated	Rel-13	LTE_LAA-Core		Wi-Fi Alliance	IEEE 802 LAN/MAN Standards Committee,		

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
							The City of New York Office of the Mayor, RAN, RAN2, RAN4		
R1-166042	Reply LS on continuous uplink transmission in eMTC	RAN1, Intel	Rel-13	LTE_MTCe2_L1-Core		RAN4, RAN2	RAN		
R1-165965	LS on RAN1 agreements potentially related to RAN2 in sidelink-based V2V	RAN1, LGE	Rel-14	LTE_SL_V2V-Core		RAN2, RAN4			
R1-166043	LS on UL DM-RS for NPUSCH format 1	RAN1, Huawei	Rel-13	NB_IoT-Core		RAN4			

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Annex C-2: List of Incoming LSs from RAN1 #85

TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
R1-163962	Reply LS on Cell FACH DTx/DRx Enhancements signalling	RAN2, Qualcomm	Rel-14	FACH_DTXDRX-Core	R1-161187	RAN1		R2-162986	
R1-163963	LS on NB-IoT RRM requirements	RAN2, Huawei	Rel-13	NB_IOT-Core		RAN4	RAN1	R2-163046	
R1-163964	Reply LS on per-UE configuration to allow exception reporting	RAN2, Qualcomm	Rel-13	NB_IOT-Core		CT1, SA2	RAN1, CT4	R2-163048	
R1-163965	Reply LS on direct SI update indication for NB-IoT	RAN2, Ericsson	Rel-13	NB_IOT-Core	R1-162068	RAN1		R2-163049	
R1-163966	Response to LS on questions on CIoT	RAN2, Vodafone	Rel-13	NB_IOT-Core		SA2, CT1	CT4, RAN1, SA3, RAN3	R2-163064	
R1-163967	Reply LS on NB-IoT	RAN2, Huawei	Rel-13	NB_IOT-Core	R1-161566, R1-162065	RAN1		R2-163125	
R1-163968	LS on the feasibility of mobility enhancement solutions	RAN2, ZTE	Rel-14	LTE_eMob-Core		RAN1, RAN3, RAN4		R2-163135	
R1-163969	LS on RLM for PSCell in dual connectivity	RAN2, Intel	Rel-12	LTE_SC_enh_dualC-Core		RAN1, RAN4		R2-163137	
R1-163970	LS on RAN2 agreements on eLAA	RAN2, Huawei	Rel-14	LTE_eLAA-Core		RAN1		R2-163146	
R1-163971	Response LS on Reply LS on questions on NB-IOT	RAN3, Nokia	Rel-13	NB_IOT-Core, CIoT		SA2, CT1, RAN2	RAN1, CT4	R3-161032	
R1-163972	LS on Parameters for WP5D Sharing and compatibility studies	RAN4, Ericsson	Rel-15	FS_NR_newRAT		RAN1		R4-162880	
R1-163973	LS to RAN on new RAN4 TR for documenting multi-node tests for LAA	RAN4, Ericsson	Rel-13	LTE_LAA-Perf		RAN	RAN1	R4-163134	
R1-163974	LS on continuous uplink transmission in eMTC	RAN4, Intel	Rel-13	LTE_MTCe2_L1-Core		RAN1, RAN2		R4-163150	
R1-163975	LS on EPC procedures for providing eNB with V2X authorization information	SA2, LGE	Rel-14	FS_V2XARC		RAN2, RAN3, SA1	RAN1	S2-162248	
R1-164114	LS regarding 3GPP LTE based technologies operating in the unlicensed bands	City of New York (Counsel to the Mayor of)	Rel-13	LTE_LAA-Core		RAN, RAN1	FCCOffice of Engineering & Technology, FCC Wireless Telelcommunications Bureau, WiFi Alliance, IEEE 802	Flore nagata May 2 2016	
R1-164119	Reply LS on questions on NB-IOT	RAN2, Nokia	Rel-13	NB_IOT-Core	R3-161032	RAN3, SA2, CT1	RAN1, CT4	R2-163290	
R1-164120	LS on direct indication DCI bits for NB-IoT	RAN2, Huawei	Rel-13	NB_IOT-Core		RAN1		R2-163292	
R1-164260	Formation of IEEE 1914 Next Generation Fronthaul Interface Working Group	IEEE 1914 Next Generation Fronthaul				RAN1, RAN2, RAN3		201604 LS IEEE1914 to 3GPP	

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TDoc #	Title	Source	Release	Related WIs	Reply to	To	Cc	Original LS	Reply in
		Interface (NGFI) Working Group							
R1-164286	LS on Remaining Issues on Path Loss Scenarios	New York University Wireless	Rel-14	FS_6GHz_CH_model		RAN1			
R1-165414	Reply LS on EPC procedures for providing eNB with V2X authorization information	SA1, LGE	Rel-14	V2XLTE	S2-162248	SA2	RAN1, RAN2, RAN3	S1-161587	
R1-165415	Reply LS on V2X message characteristics	SA3, TNO	Rel-14	V2XLTE	S1-154509	RAN2, SA1	SA2, RAN1	S3-160777	
R1-165417	LS on TB sizes for SI-messages for NB-IoT	RAN2, Ericsson	Rel-13	NB_IOT-Core		RAN1		R2-163294	
R1-165449	Review of 3GPP LAA Specification Rel. 13	IEEE 802 LAN/MAN SC	Rel-13	LTE_LAA-Core		RAN1	RAN, IEEE 802.19 Coexistence	802 to 3GPP 22 May 2016 Liaison r00.pdf	
R1-165655	LS to RAN1 on RAN2 agreements related to V2X	RAN2, LGE	Rel-14	FS_LTE_V2X		RAN1		R2-164373	
R1-165722	Reply LS on questions on NB-IOT	CT1, Nokia	Rel-13	NB_IOT-Core, CIoT-CT	R3-161032	RAN3, RAN2, SA2	RAN1, CT4	C1-162926	
R1-165723	LS to RAN1 on SPS	RAN2, LGE	Rel-14	LTE_SL_V2V-Core		RAN1		R2-164359	
R1-165727	LS on V2V transmission path selection	RAN2, Huawei	Rel-14	LTE_SL_V2V-Core		SA2, RAN1, RAN3		R2-164356	
R1-165753	Reply LS on NB-IoT RRM requirements	RAN4, Huawei	Rel-13	NB_IoT-Core	R2-163046	RAN2	RAN1	R4-164085	
R1-165754	LS on RRM measurement for NB-IOT	RAN4, Ericsson	Rel-13	NB_IoT-Core		RAN1, RAN2		R4-164454	
R1-165817	Response LS on PUSCH transmission for eLAA	RAN4, Nokia	Rel-14	LTE_eLAA-Core		RAN1		R4-164678	
R1-165838	LS to RAN1 on RAN2 agreement on eLAA	RAN4, Nokia	Rel-14	LTE_eLAA-Core		RAN1		R2-164489	
R1-165894	Response to LS on uplink transmission gap in NB-IoT	RAN4, Sony	Rel-13	NB_IoT-Core	R1-162069	RAN1	RAN2	R4-164459	
R1-165895	LS on Tx Gaps for Frequency Error Correction	RAN4, Qualcomm	Rel-13	NB_IoT-Core		RAN2	RAN1	R4-164532	
R1-166004	Response LS on realistic power amplifier model for NR waveform evaluation	RAN4, Nokia	Rel-14	FS_NR_newRAT		RAN1		R4-164542	

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Annex D: List of Approved updated WIDs

None

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Annex E: **List of draft TSs/TRs agreed at RAN1 #85**

Tdoc Number	Title	Source	Conclusion/Decision

Petitioners' Exhibit 1007, p. 1984
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Annex F: List of actions

- **Outgoing LS.**

[85-07] Hanbyul (LGE)
V2V LS (summarizing all the agreements/working assumptions made during the week) to RAN2/4 for email approval until June 2nd
Done: Final LS is agreed, according to Mr Chair's email posted on June 3rd, as follows:
R1-165965 LS on RAN1 agreements potentially related to RAN2 in sidelink-based V2V RAN1, LGE

[85-26] Matthew (Huawei)
LS to RAN4 about UL DM-RS for NB-IoT for email approval until June 2nd
During the meeting, we agreed to to send LS to RAN 2 and cc-RAN 4 on UL DMRS hopping, but agreed LS did not include RAN4
Done: Final LS is agreed, according to Mr Chair's email posted on June 3rd, as follows:
R1-166043 LS on UL DM-RS for NPUSCH format 1 RAN1, Huawei

[85-27] Sorour (Ericsson)
UL category for UL capacity enhancement for email approval until June 2nd
There was a typo that UL Category 15 instead of 17 in the RAN1 agreements as well as the LS R1-166034 to RAN2.
Done: Final LS is agreed, according to Mr Chair's email posted on June 3rd, as follows:
R1-166044 LS on Uplink Capacity Enhancements for LTE RAN1, Ericsson
R1-166044 supersedes the former agreed LS in R1-166034.

- **CR approval**

[85-02] Johan (Ericsson)
R1-165958 MPDCCH search space for random access in connected mode for BL/CE UE Ericsson
Email approval until June 3rd
Done:

[85-04] Editors/Rapporteur
NB-IoT CRs - Editors should provide updated CRs to 36.211, 36.212, 36.213, 36.214 by June 3rd , for approval by June 7th
Rapporteur shall submit a summary of all agreements by May 30th
Done:

[85-06] Editors/Rapporteur
eLAA CRs
Editors will submit draft CRs (201, 211, 212, 213, 214 (if needed)) until 18th August
Rapporteur needs to submit agreement and WA lists until 30th June

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[85-08] Editors/Rapporteur
V2V CRs
Editors will submit draft CRs (201, 211, 212, 213, 214) until 18th August based on the following list
Rapporteur needs to submit agreement and WA lists until 30th June

- **Text proposal for TS and TR**

[85-32] Peter (Huawei)
TR25.707
Email discussion on updated TR25.707 until Monday June 6, 2016.
Done: .

- **Miscellaneous**

[85-30] Harish (Qualcomm)
Clarifications to DCH enhancements feature Email discussion on proposals 2/4/7/8 from R1-164364 until June 8, 2016

[85-31] Gerardo (Ericsson)
R1-165336 Clarification on UL DPCH 10ms Mode
Email approval until June 8, 2016

[85-01] Aris (Samsung)
R1-164733 HARQ-ACK Codebook on PUSCH for TDD
Email discussion until 30th June

[85-03] Hao (Qualcomm)
Clarification on CSI measurements for eMTC
Email discussion on the issue raised in R1-164399 and R1-165542 till 10th June

[85-5-1] Scheduling aspects for eLAA, Joon (LGE)
Scheduling aspects including BD reduction and working assumptions on some fields
Email approval until 6th June

[85-5-2] Resource allocation aspects for eLAA, Srinivas (Qualcomm)
Resource allocation aspects including resource allocation type alternatives and applicability of fields for legacy vs. interlaced resource allocation
Email approval until 6th June

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[85-5-3] PUSCH structure, Havish (Ericsson)
Start times of PUSCH transmission including within first OFDM symbol and means to achieve this
Email approval until 6th June

[85-5-4] SRS aspects, Xia Yuan (Huawei)
SRS aspects including triggering of SRS without PUSCH with DL grants and common/group DCI
Email approval until 6th June

[85-5-5] UCI on an LAA SCell, Havish (Ericsson)
Further discussion on transmission of HARQ-ACKs on an LAA SCell
Email approval until 6th June

[85-5-6] Channel access framework, Sorour (Ericsson)
Channel access aspects including Cat. 4 LBT parameters, CW adjustments for Cat. 4 LBT, Signaling of LBT type, ED threshold, DL-UL traffic multiplexing and LBT parameters for SRS
Email approval until 6th June

[85-5-7] RRC parameters, Havish (Ericsson), Xia Yuan (Huawei)
RRC parameter list for eLAA
Email approval until 6th June

[85-09] Hanbyul (LGE)
Semi-persistent transmission for mode 2 for V2V
Email approval about above FFSs until 9th June

[85-10] Joerg (Ericsson)
R1-165438 Simulation assumptions for eMBMS
Email approval until 30th June

[85-11] Alberto (Qualcomm)
eMBMS proposal
Email approval about above proposed agreements and proposed working assumptions until 30th June

[85-12] Hanbyul (LGE)
TP for V2V
Email approval of TP for TR including approval of next version of TR and updated simulation results by 2nd June

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[85-13] Alexei (Intel)
Antenna model for NR
Email approval about brackets in R1-166026 until 9th June

[85-14] Hasegawa (Mitsubishi)
R1-166001 Evaluation assumptions for high speed train scenario for NR
Email approval until 8th June about brackets and FFS parts

[85-15] Youngtae (LGE)
Performance metrics for NR
Email discussion on performance metrics, starting from the ones in R1-165612, till 8th June

[85-16] Frank (Huawei)
Calibration for NR waveform
Email discussion until 30th June

[85-17] Frank (Huawei)
Collect information for NR waveform
Email discussion until 4th August

[85-18] Mihai (Nokia)
PA assumption for NR
Email discussion and approval about power amplifier assumptions for NR DL waveform evaluations by utilizing R1-166004 and R1-166010 and also email approval to confirm above WA until 9th June

[85-19] Young-Han Nam (Samsung)
Large scale calibration for channel model
For updating results for large scale calibration: Until June 10th

[85-20] Young-Han Nam (Samsung)
Full calibration for channel model
For full calibration results: Until June 25th

[85-21] Young-Han Nam (Samsung)
Additional feature calibration for channel model
For additional feature calibration: Until July 25th

[85-22] Young-Han Nam (Samsung)

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TP for channel model
For approval of the summary for all the calibration results and updated TP: Until Aug 10th

[85-23] Young-Han (Samsung)
TR38.900 for channel model
Email approval to check the consistency with the agreements in this meeting and the previous meeting until 2nd June

[85-24] Hanbyul (LGE)
RRC parameter lists for V2V
Email approval until 2nd June

[85-25] Taeyoung (Samsung)
UE noise figure for NR for email approval until 2nd June
Done: As per Mr chair's email decision posted on June 3rd, the following clarification is agreed:

- **The agreed noise figures (baseline performance: 13dB, high performance: 10dB) for evaluation of NR above 6GHz apply for both "Dense urban" and "Urban macro".**

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3GPP TSG RAN WG1 Meeting #86 **R1-16xxxx**
Göteborg, Sweden, 22nd – 26th August 2016

Annex G: List of participants at RAN1 #85

Please see excel file attached to this report

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Annex H: **TSG RAN WG1 meetings in 2016 – 2017**

TITLE	TYPE	DATES	LOCATION	CTRY
3GPPRAN1#86	WG	22 – 26 Aug 2016	Goteborg	Sweden
3GPPRAN1#86bis	WG	10 – 14 Oct 2016	Lisbon	Portugal
3GPPRAN1#87	WG	14 – 18 Nov 2016	TBD	US
3GPPRAN1#88	WG	13 – 17 Feb 2017	Athens	Greece
3GPPRAN1#88bis	WG	03 – 07 Apr 2017	TBD	US
3GPPRAN1#89	WG	15 – 19 May 2017	TBD	China
3GPPRAN1#90	WG	21 – 25 Aug 2017	Berlin (TBC)	Germany
3GPPRAN1#90bis	WG	09 – 13 Oct 2017	Prague (TBC)	Rep Czech
3GPPRAN1#91	WG	27 Nov – 01 Dec 2017	TBD	US

MEETING TYPES	
AH = Ad Hoc	CM = Chairmen's meeting
JM = Joint	OR = Ordinary
PM = Preparatory Meeting	RG = Rapporteurs Group
RM = Resolution Meeting	SG = Steering Group
ST = Startup Meeting	TG = Task Group
WG = Working Group	XO = Extraordinary

End of document

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